



## Authorizations and Permits for Protected Species (APPS)

File #: 21585

Title: Tagging and biopsy sampling cetaceans to char

Modification: 1

### File Number: 21585

#### Applicant Information

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#### Project Information

**File Number:** 21585

**Application Status:** **Application Complete**

**Project Title:** Tagging and biopsy sampling cetaceans to characterize movement patterns, distribution, foraging ecology, and critical habitat requirements.

**Project Status:** New

**Previous Federal or State Permit/Authorization:** 14856

**Permit/Authorization Requested:**

- MMPA/ESA Research/Enhancement permit - Expired

**Where will activities occur?** US Locations including offshore waters  
International waters

**Research Timeframe:** **Start:** 12/20/2018 **End:** 12/31/2023

**Sampling Season/Project Duration:** This project consists of multiple field seasons (likely a maximum of 2/stock/species) per year, the timing/duration of which will depend on the species. Field seasons may take place any month and typically last 2-6 weeks. The requested duration of this permit is five years and includes several species as well as more than one stock/species annually.

Our first field season is planned for February 2019, tagging humpback whales in Hawaii for the U.S. Navy's Pacific Northwest Cooperative Ecosystem Studies Unit. The next project may occur in Summer 2019, in the Gulf of Mexico tagging sperm whales.

**Abstract:** We request authorization to tag and biopsy sample 50 each of humpback (*Megaptera novaeangliae*), blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), southern right (*Eubalaena australis*), Eastern North Pacific stock gray (*Eschrichtius robustus*), and sperm whales (*Physeter macrocephalus*), 25 non-Gulf of Mexico (non-GOMx) Bryde's (*Balaenoptera edeni*) whales, 10 North Pacific right whales (*Eubalaena japonica*), 12 Western North Pacific stock gray whales (*Eschrichtius robustus*), in U.S. and international waters, annually.

Satellite-monitored radio tags will be deployed to monitor movements and dive behavior of these species. Our objectives are to characterize spatial and temporal distribution of whales throughout their range, identify migration routes, home ranges and core areas, characterize foraging behavior, and identify ecological relationships to help explain movement patterns. Tagged whales will be approached for photo-identification, behavioral observation, and assessment of possible tag effects. Genetic analysis of biopsy samples will provide sex determination, individual identification, species and stock identification. Biopsy samples may also be analyzed for reproductive condition, stable isotope ratios, toxicology, and lipid content. We request authorization to biopsy sample 20 non-tagged whales in the above-mentioned species to further refine population structure through genetic analyses.

We request authorization to conduct Level B harassment (photo-identification/behavioral observation) on other marine mammal species (including pinnipeds) encountered opportunistically during our research, to contribute to knowledge of species for which little information has been documented, to provide documentation of human interactions (injuries or entanglements) and health concerns, or to document range expansions (observations of species out of their usual habitat).

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## Project Description

**Purpose:** Satellite-monitored radio telemetry and data-logging devices will be used to study the movements and dive characteristics of free-ranging cetaceans. The objectives of the proposed research are to characterize the spatial and temporal distribution of whales throughout their range, identify migration routes, home ranges and core areas of use, characterize foraging behavior, identify important habitat, and characterize ecological relationships to help explain whale movement patterns. Such information will support monitoring efforts to better characterize the extent and patterns of use in areas where human activities could have potential adverse impacts on whale populations. We will test the following hypotheses: (1) are migration routes and destinations consistent from year to year; (2) do different age/sex classes within the same species exhibit different movement patterns and behavioral characteristics; (3) are there bathymetric, oceanographic and/or ocean climate variations that can help explain whale movements and behavioral characteristics.

Biopsy samples will be collected from tagged whales at the time of tagging. Subsequent biopsy samples from tagged whales may also be collected during follow-up studies, with up to two samples taken per year per tagged whale. Samples will provide sex information, genetic identification, and stock structure information, as well as stable isotope ratios, toxicology information, lipid composition, and pregnancy confirmation, all of which will lead to better interpretation of tracking data. Sex and pregnancy information will allow for the comparison of movement patterns and diving behavior between males and females which could have significant population-level consequences with respect to energetic requirements and exposure to risk, especially for those portions of populations considered most vulnerable. Stable isotope ratios can provide information about the trophic level and prey composition of the whale's diet, which, when combined with tracking data can help inform migration patterns and validate the interpretation of other studies in which only biopsy data are available. Analysis of multi-year stable isotope ratios in blubber can address questions regarding whales' responses to changing oceanographic conditions by providing evidence of changes in foraging habits. Toxicology analysis from blubber samples of tagged whales will provide geographic information about human stressors and analysis of multi-year pollutant levels can be very valuable in the assessment of impacts from anthropogenic sources of pollutants, including coastal development and oil spills. Lipid content in the blubber of both tagged and untagged whales will allow for comparisons between feeding and breeding areas for migrating baleen whales. Lipid content in whales at the time of tagging and on subsequent occasions can be informative in the assessment of body condition and improve our evaluation of tagging impacts, especially when combined with seasonal lipid information from untagged whales.

We are also requesting permission to collect biopsy samples of up to 20 additional non-tagged conspecifics during the conduct of tagging operations. Keeping in mind that we typically tag 12-25 whales per site/season, the purpose of this request is to increase our sample sizes for the analyses described above, many of which rely on minimum sample sizes of > 30 to be able to provide statistically valid information.

The results of our previous tagging studies have yielded much toward our understanding of whale movements, distribution, behavior, tag effects and wound healing. Irvine et al. (2014) identified hotspots for blue whales off the U.S. west coast (based on 11 years of tracking data) that overlap with shipping traffic off San Francisco and in the Santa Barbara Channel. Such information is critical to the identification of ship-strike risk to whales and in the mitigation of such risk.

Our humpback whale tagging off Gabon (Rosenbaum et al. 2014) provided the first migratory route information between West Africa and sub-Antarctic feeding areas and identified areas of potential overlap between whale habitat and human activities, such as oil and gas extraction and shipping. This study also documented strong heterogeneity in humpback movement, reinforcing previous genetic evidence of the occurrence of multiple populations of humpback whales off West Africa.

Mate et al. (2015) documented the first full migratory route and destination for a Western gray whale (WGW). This female, tagged in late summer, traveled a total of 22,511 km on a round-trip from Sakhalin Island, Russia, to the west coast of North America and down to Baja California. She visited all three known breeding lagoons for Eastern gray whales (EGW) in the winter before returning to Russia the following spring. Two other Western gray whales tagged off Sakhalin Island also migrated to regions off the west coast of North America, traditionally occupied by Eastern gray whales. These migrations strongly suggest that some presumed WGWs are actually EGWs foraging in areas historically attributed to WGWs. The observed migration routes provide evidence of navigational skills across open water that break the near-shore north-south migratory paradigm of EGWs. Despite evidence of genetic differentiation, these tagging data indicate that the population identity of whales off Sakhalin Island needs further evaluation.

Hazen et al. (2016) combined our large satellite telemetry data set for blue whales (1994-2008) with oceanographic correlates to provide a year-round prediction of potential blue whale habitat. This near-real-time tool allows an examination of the spatio-temporal overlap of blue whales with potentially harmful human activities, such as shipping, and can be used by managers to develop seasonal and dynamic management approaches to help reduce the risk of ship strikes for blue whales in the California Current.

Winsor et al. (2017) examined the distribution of tagged sperm whales in relation to seismic airgun activity in the Gulf of Mexico and found that both distances and orientations between the whales and active airgun arrays appeared to be randomly distributed with no evidence of horizontal avoidance, at a spatial scale of 5-50 km from the seismic vessel.

Mate et al. (2017) introduced a new Advanced Dive Behavior (ADB) tag, which provides high resolution dive behavior data and GPS locations for periods up to 7 weeks, bridging the gap between long-duration location-only tags and short-duration high-resolution data loggers. ADB tags record dive depths, 3-axis accelerometer and magnetometer data, water temperature, and light levels, and have been successfully deployed on blue, fin, and sperm whales. Feeding lunges can be detected in blue and fin whale dives as peaks in accelerometer data, and prey pursuit by sperm whales can be identified as rapid orientation changes often in the bottom phases of dives, greatly increasing our understanding of foraging ecology for these species. Ten ADB tags were recovered from sperm whales in the Gulf of California, Mexico, in 2007-2008 (Irvine et al. 2017), providing multi-week dive records from which diving behavior, activity budget, and individual variation could be characterized. Hierarchical cluster analysis revealed six categories of dives, over three-quarters of which were likely associated with foraging or searching for prey (Mid-water, Benthic, V-shaped, and Variable) while the remainder were likely associated with resting or socializing (Short and Long-duration shallow). Median maximum dive depth was 340 m for Mid-water U-shaped dives, comparable to daytime dive depths of Humboldt squid, sperm whales' primary prey in the Gulf of California. Benthic dives for one whale occurred in an area with a mean seafloor depth of 392 m, quite a bit shallower than waters in which sperm whales are typically found, and may have represented a switch to feeding on demersal fish rather than squid. Three tagged whales traveling in close proximity to one another exhibited non-synchronous dive patterns, suggesting they were foraging on a vertically heterogeneous prey field.

The sharing of our identification photos of tagged whales with other researchers studying the same species has led to follow-up investigations of the effects of tagging on individual whales. Best et al. (2015) showed that the reproductive rates of tagged southern right whales were similar to that of untagged whales, and unchanged from their pre-tagging reproductive history, using photographic resights of tagged whales up to 11 years after tagging. Tags were shed from all but one of these whales within 36 months of tagging (the exception was a tag that remained attached 11 years after tagging), and healing of the tag site occurred within five years of tagging (2 years of tag shedding). Norman et al. (2017) provided a qualitative and quantitative assessment of wound healing for tagged blue and gray whales and showed that gray whales appeared to be more reactive in their wound response to tagging compared to blue whales. Swelling occurred in 74% of reencountered gray whales and usually resolved over time, whereas swellings were common in blue whales with early tag designs (prior to 1997) but rare with current models. To reduce wound severity, the authors recommended placement of tags higher on the whale's back and improvements in tag design to minimize breakage and eliminate parts being left behind in animals,

the latter of which has been accomplished by our program since 1997.

Despite the advancements outlined above, our knowledge of whale movements and distribution is far from complete, particularly outside U.S. waters. For some of the species listed in this application, the location of either their feeding or breeding areas remains unknown, as do their migratory routes. Additional studies using satellite-telemetry and data-logging devices will build upon past research and help us identify unknown habitats and further our understanding of the distribution and 3-dimensional movements of cetaceans in the world's oceans. Such information allows for improved understanding of critical habitat requirements and amount of whales' exposure to anthropogenic activities (shipping, fishing, seismic activity, renewable energy development and operation). An appreciation of the areas of the ocean that are critical to whales and what oceanographic features are associated with these areas can help in the identification of regions and conditions warranting special protection (Hooker et al. 2007). For conservation measures to be successful, predictive habitat models will require ongoing validation to ensure the species-environment relationships identified thus far persist in the future, particularly in a changing climate (Hazen et al. 2016).

#### Sample Size:

In order to test these hypotheses, we are requesting authorization to tag annually worldwide up to 50 individuals each of humpback, blue, fin, non-GOMx Bryde's, southern right, Eastern North Pacific gray, and sperm whales; up to 10 North Pacific right whales; and up to 12 Western North Pacific gray whales. In previous tagging studies of right whales, bowheads, blue whales, and sperm whales, individuals within the same species have been shown to have different movements and dive habits (Mate and Nieuwirth 1992, Mate et al. 1997, Mate et al. 1999, Krutzikowsky and Mate 2000, Lagerquist et al. 2000, Mate et al. 2000, Irvine et al. 2017). We have found evidence that males, females, and females with calves show differences in surfacing rates and movements within/between feeding and breeding areas (Mate et al. 2003, Lagerquist et al. 2008, Mate et al. 2011). In addition to sex differences, we wish to explore whether there are differences between juvenile and adult behaviors. This results in five population subgroups (adult males, adult females without calves, females with calves, juvenile males, and juvenile females). Twenty-five per field season represents a minimum sample size to allow for statistical comparisons between the five subgroups, allowing for some tags to fail. Our requested takes reflect numbers we feel are necessary to provide a representative sample given the high degree of individual variation we see in whale distribution and behavior as well as variation in tag duration and potential tag failure. As stated earlier in the application, prior authorization is necessary not only for many grant proposals, but also to allow us to respond to research opportunities that have less than a 12-18-month lead time (or the time it would take to secure MMPA/ESA authorization if not already permitted). As an example, we were asked in 2010 to tag sperm whales in the Gulf of Mexico during the time of the Deepwater Horizon oil spill with one-month's advance notice. If not already authorized to tag sperm whales, we would not have been able to fulfill that request.

The achievement of 100 percent success in tag deployment, retention, and function is rare. Tags may be imperfectly deployed due to a number of reasons, including whale movement at the time of deployment, individual whale differences in tissue density at the tagging site, differences in air pressure in the deployment equipment, or malfunctions of the deployment equipment. Hydrodynamic drag is a constant force trying to pull the tag from the whale's body, and tag retention is a function of how fully a tag is deployed, the angle of deployment, and tag location on the whale's body. Individual variation in tissue response and how this contributes to tag retention as well as the migration of foreign material out of tissue also plays a role in how long a tag remains attached to individual whales. Tags may not function properly if they are damaged upon deployment or from contact with other whales, as may be the case with mother/calf pairs or whales engaged in breeding activities. Such whale-to-whale contact may also affect tag retention. We learn valuable information from tagging animals during the breeding season, including mothers with calves, even though some tags may be vulnerable to damage from whale-to-whale contact (from calves or breeding activities). We can't predict how many, if any, will be damaged, and the information we learn from these tags may be the only way to provide answers to certain key recovery questions. A good example of this would be tagging humpback whales from the Central America Distinct Population Segment (DPS-6), which are considered Endangered. Accurate long-range information about their migration routes and distribution is critical to the conservation and management of this population and tagging these animals on their breeding ground may be the best way to provide this information.

Because only 60% of our ARTS-applied Argos satellite tags transmit for 2 months or more, a minimum of 5 animals per subgroup (3 + 2 potential "failures") is necessary to ensure a successful time series of data permitting statistical comparisons between subgroups. For analysis of longer-term trends, only 30-50% of tags last longer than six months requiring 6+ animals per subgroup. The 25 requested per most experiments allows for larger than minimum sample sizes in fewer subgroups, in cases where all five subgroups are not represented equally, and for the possibility that all 25 tags are not able to be applied (which frequently occurs due to field logistical complications and weather limitations). Lower sample sizes are requested for populations with small population sizes; 12 tags annually for the critically endangered Western North Pacific gray whale, and 10 tags annually for North Pacific right whales. These sample sizes would still allow for comparisons between males and females, but would not provide adequate sample sizes from all five population subgroups. While we don't know the sex of tagged whales prior to our analysis of their biopsy samples (with the exception of mothers with calves), our past tagging of blue, fin, and humpback whales has resulted in similar number of males and females tagged. A balance in sex

can be more assured with a higher sample size.

As individual variability in many behaviors is quite high, the minimal sample size may not provide sufficient power to distinguish anything but relatively large differences between groups. Additionally, we are still striving to understand what constitutes a meaningful (effective) sample size for each behavior before we can perform more stringent power analyses. For example, in an attempt to detect differences in the speeds between male and female sperm whales, a sample size of 18 (10 females, 5 males, 3 unsexed), had insufficient power to detect a 10% difference in speeds (90% power; 95% confidence level). However, we were able to distinguish surfacing rate differences between southern right whale cows with calves ( $n = 4$ ) and other adults ( $n = 11$ ). As our database continues to grow and we gain an understanding of the sources of variability (i.e. year, season, age/sex class, environmental factors, etc.) we may be able to perform analyses across years to test hypotheses with sufficient power. For example, Bailey et al. 2009 combined our data from 14 experiments of blue whales over a 15-year time span (total 128 successful tags) and detected significant speed of travel differences between migratory and area restricted search (feeding) behaviors. Knowledge about differences in movements and behavior between the sexes (including travel speed) can help inform interpretation of tracking data and establish energy requirement differences between whales. This in turn can help inform our assessment of risk to various classes of whales from anthropogenic activities, such as how long it takes whales to travel through areas of coastal development or away from naval or seismic activity. Speed information can help refine spatial models of movement and behavior, such as for state space modeling of Argos data, which will lead to more accuracy in the remote classification of behavior.

We have requested to tag 50 individuals of each species annually (for most species), as this will allow for two field seasons (i.e. different locations) for a particular species in a given year. Our request for at least two possible experiments (field seasons) of each species in a year gives us the option to add to our knowledge about animals in different geographical/seasonal areas, different stocks, and/or under different environmental conditions. The possibility of multiple studies per species occurring in all 5 years is extremely low. However, we have based our total number of requested animal takes on just that possibility to ensure we are covered should such opportunities arise (especially for international collaborations). As we have seen with blue whales (Bailey et al. 2009), their inter-annual variation in movement patterns is significant, requiring many years of data and enough tagged animals to establish an idea of their variability and thus allow a more complete description of movement behavior.

For ESA-listed and MMPA-depleted species:

Endangered species are specifically targeted in the requested activities, as information concerning them is critical for their protection. Management and conservation of such species cannot be effective without accurate information concerning their distribution, movements and critical habitats (for migration, feeding and reproduction).

Our proposed research will directly contribute to the objectives identified in species' recovery plans. NOAA's Recovery Plan for humpback whales (1991) identifies the need for radio tag studies to provide detailed long-term and long-range information on habitat use and migration, in the effort to identify additional habitats that might require protection and to determine the likelihood that migrating humpbacks might be exposed to serious environmental threats. NOAA Recovery Plans for blue (1998), fin (2010), and sperm whales (2010) all list the need to assess daily and seasonal movements and inter-area exchange, using telemetry and photo-identification. They also recommend improving our knowledge of whale feeding ecology and the characteristics of important whale habitat, as well as the identification of areas where concentrations of whales coincide with significant levels of maritime traffic, fishing, or pollution. NOAA Recovery Plans for North Pacific right whales (2013) and North Atlantic right whales (2005) also recommend the use of satellite tags to assess range, distribution, movements, feeding ground use and to identify wintering areas. The long-term, long-range goals of these recovery plans are best met with the deployment of long-term fully-implantable (with the exception of antennas and stops) tags, rather than LIMPET tags. Tag durations (days of transmissions) for fully-implantable tags (means, medians, maximums, and upper quartiles) are longer (2 to 5 times longer in some cases) than for LIMPETs for species in which comparisons are possible (blue, fin, humpback, and sperm whales; See attached Table 1 of tag durations). The identification of unknown habitats and sources of risk are critical to the protection of threatened and endangered species and may only be possible with the long term tracking data that fully-implantable tags can provide, at the present time.

The satellite tracking studies proposed here will help meet the objectives outlined above, by providing detailed daily and seasonal movements of individual whales, identifying migration routes and timing, and identifying areas of high-use. They also have the potential of addressing questions of exchange between subpopulations. Identification of unknown areas of use will help determine levels of exposure to anthropogenic activities and will identify areas in which to direct future research. The examination of the relationship between whale movements and oceanographic features will allow us to characterize habitat preferences of whales and further our understanding of how whales may respond to changes in oceanographic conditions. Data-logging devices will improve our understanding of dive characteristics and can be combined with information of prey distribution to further our understanding of whale foraging ecology. The determination of the percentage of time whales spend at or near the surface helps estimate their sightability for aerial or shipboard surveys and leads to the development of correction factors

for improving the accuracy of abundance estimates. We have found that surface characteristics vary by species and behavior (feeding versus migration versus breeding) and even by reproductive class (females with calves versus adults without calves). Acoustic devices will improve our understanding of the levels of anthropogenic sound to which whales are exposed and, when combined with movement and dive habit information, will help in determining whale's reactions to such sounds.

Species management and conservation efforts require an accurate understanding of whale abundance, distribution, and critical habitat requirements, as well as the amount of exposure to anthropogenic activities and the impacts of such activity. As outlined above, satellite telemetry and data-logging studies contribute greatly to this information, not only in identifying areas in which to direct further research and abundance survey efforts, but also in providing detailed movement and dive habit information on individual whales. Such information will contribute directly to the understanding of basic biology and ecology of the species requested, in terms of identifying year-round distribution patterns, migration routes, speed, and timing, dive and surface characteristics, foraging ecology, and sound production. This information is, in turn, necessary for successful conservation of species, by improving our understanding of the role these animals play in the ocean community, how they may be affected by changing oceanographic conditions, how they are affected by human activities, and how to mitigate these effects.

**Description:** Up to 50 each of humpback (*Megaptera novaeangliae*), blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), southern right (*Eubalaena australis*), Eastern North Pacific stock gray whales (*Eschrichtius robustus*), and sperm whales (*Physeter macrocephalus*), 25 non-GOMx Bryde's (*Balaenoptera edeni*), 10 North Pacific right whales (*Eubalaena japonica*), and 12 Western North Pacific stock gray whales (*Eschrichtius robustus*), may be tagged and biopsy sampled annually during the five year duration of this permit. During the course of tagging/biopsy operations, multiple candidate whales may be approached before a tag is successfully applied.

No more than 50 humpbacks, blues, fins, southern rights, Eastern North Pacific grays, or sperm whales will be tagged in a single calendar year, but up to 300 Level B takes may occur annually (via harassment) for each of these species (or 500 in the case of humpback whales) during the tagging process. A maximum of 25 non-GOMx Bryde's whales may be tagged in a single year, and up to 200 Level B takes (harassment) may occur annually. A maximum of 12 Western North Pacific stock gray whales may be tagged in a single year, and up to 200 Level B takes (harassment) may occur annually. A maximum of 10 North Pacific right whales will be tagged in a single year, but up to 100 Level B takes (harassment) may occur annually. These takes include approaches to tagged whales both before and after tagging, as mentioned above, as well as to conspecifics that may occur in groups with tagged whales. In many cases, these takes do not involve close approaches and any potential disturbance is minimal and short-term.

#### Tagging

Whales will be tagged with a fully-implantable Argos satellite-monitored radio tag, a partially-implantable Argos-linked Fastloc GPS/TDR tag with or without an acoustic dosimeter, or a combination of these two tag types. No whales will be tagged that appear emaciated (having a post-cranial depression, subdermal protrusion of the scapula, or depression along the dorsal aspect of the lateral flanks; Brownell and Weller 2001). Each tagged whale may also be biopsied resulting in potentially three Level A takes per animal, should all 3 procedures occur on separate days annually. For most species, it may be necessary to maintain close proximity to individual animals for a period up to one hour (longer for sperm whales due to their long dive durations) to assure appropriate positioning before tag application and for identification photographs. Tagged whales will be re-approached for subsequent close-range behavioral observation, tag assessment, and the evaluation of wound healing and tag effects. This post-tagging monitoring may result in tagged whales being approached multiple times annually. We are requesting authorization to approach tagged whales up to 12 times per year (12 Level B takes) for such evaluations. This number would allow us to conduct dedicated approaches to tagged whales, as well as inadvertent approaches if tagged whales unknowingly occur in the same group as other candidates for tagging, or require approaches closer than 100 yards to confirm the presence of a tag. We will endeavor to make these approaches brief and leave animals once good quality photographs (if still needed) are obtained. Tagged whales may also be biopsy sampled up to two more times per year (but not in the same month) if resighted, to improve our understanding of wound healing and tag effects through lipid content analysis. This may result in an additional 2 Level A takes for those individuals. No individual animal will experience more than four Level A takes annually.

Adults and juveniles greater than 10 m in length, of both sexes will be tagged, including females with calves of any age. Calves will not be tagged with the exception of blue whales. Blue whale calves older than 6 months or longer than 10 m in length are big enough, to accommodate a tag and therefore will be included in our experiments. We want to obtain long-term movement and dive information on mothers with younger calves to determine how mothers and calves use their reproductive areas, as this is important information regarding their exposure to anthropogenic activities in these areas and can identify special areas used by this group. It is equally important to know where mother/calf pairs go when they leave these areas and what routes they take. To determine whether mothers migrate to the same place as males or non-lactating females, we would have to tag mothers with calves younger than 6 months.

We will attempt to tag equal proportions of adults/juveniles/ and males/females (in cases where males and females can be distinguished), but this will not always be possible because of the inherent difficulty in tagging whales and the common inability to distinguish males from female baleen whales in the field. The desire to tag whales of different age and sex classes comes from the observed variation shown in previous studies. In previous tagging studies of right whales, bowheads, and blue whales, individuals within the same species have been shown to have different movements and dive habits (Mate and Niekirk 1992, Mate et al. 1997, Mate et al. 1999, Krutzikowsky and Mate 2000, Lagerquist et al. 2000, Mate et al. 2000). More recently, we have found evidence that males, females, and females with calves show differences in surfacing rates and movements within/between feeding and breeding areas (Mate et al. 2003, Lagerquist et al. 2008, Mate et al. 2011). Additional tagging of different age and sex classes will allow us to continue to explore the significance of such differences.

Tagging will take place during approaches in small (usually <8 m) boats (either rigid-hulled inflatables or fiberglass hulls). Approaches to whales will be limited to tagging/biopsy darting, photo-identification and photo-documentation of tag attachment, and behavioral observations. Animals may be approached as closely as 1 m for tagging, with approaches typically no closer than 5 m for biopsy-darting (if biopsy is not obtained during the tagging approach), photography, and observation. Approaches usually occur from behind and to one side of the whale. Whales will not intentionally be approached head on. During tag deployment, the vessel speed will be slightly greater than the whale's speed in order to catch up to the whale and position the tag. Individual whales are typically only closely approached once to deploy a tag, but in some cases two or three "tagging approaches" may occur for successful tag deployment. All satellite tags will be applied using a modified air-powered line-thrower, similar to the ARTS system designed by Heide-Jorgensen et al. (2001). A buoyant deployment shaft fits into the applicator barrel and holds the tag. The shaft separates from the tag after attachment and is usually recovered. Tags will be placed on the dorsal surface of the animals, typically just below or forward of the dorsal fin/ridge/hump or, in the case of adult blue whales, up to approximately 5 m in front of the dorsal fin, or at least 2 m behind the blowhole in the case of right whales.

In the case of two tags being deployed on the same individual, both tags may be deployed at the same time, or on subsequent surfacings, perhaps even on subsequent days. Transmissions have the best chance of successfully reaching a satellite receiver when a tag is positioned close to the midline of the whale's back, in an area that is above water for the longest period of time. In addition, Norman et al. (2017) showed a reduction in tag wound severity with placement of tags higher on a whale's back. Therefore, tags will be positioned close to one another high on a whale's back for both optimal satellite uplinks and decreased wound response. We do not expect any negative consequences from an animal bearing two tags, due to the findings from follow-up observations of tagged whales by our group and others described in the Anticipated Effects on Animals section of this application.

On some field projects, we will use larger vessels (30+ m in length) as support vessels and as our home base when far from shore. The smaller tagging vessel is launched from the larger vessel for day operations, but the two boats may work in tandem to locate whales for tagging or follow-up photographs and observation. The larger vessels will not intentionally approach whales closer than 10 m.

Research objectives will be met through the deployment of non-recoverable Argos satellite-monitored long-duration tags (hereafter referred to as non-recoverable tags) and/or recoverable Argos-linked Fastloc GPS/TDR intermediate-duration tags (hereafter referred to as recoverable tags). The non-recoverable tag is almost fully implantable, while the recoverable tag is only partially implantable.

The non-recoverable tags are composed of a main body, a penetrating tip, and an anchoring system (Figures 4 and 5 – see Supplemental Information section. The main body consists of a certified Argos transmitter (either Wildlife Computers SPOT or Telonics ST-27) housed in a stainless-steel cylinder (2.1 centimeters [cm] maximum diameter × 23.0 cm maximum length) and deploys to a depth of 29.5 cm. A flexible whip antenna and a saltwater conductivity switch are mounted on the distal endcap of this cylinder, while a penetrating tip is screwed onto the other end. The distal endcap has two perpendicular stops (0.83 cm maximum thickness) extending approximately 1.5 cm laterally to prevent tags from embedding too deeply on deployment or from migrating inward after deployment. In the Wildlife Computers tags, the distal endcap and stops are made of stainless steel, while the Telonics endcap and stops are made of polycarbonate material. Endcap and stop dimensions are not significantly different between the two manufacturers. The penetrating tip consists of a Delrin® nose cone, into which is pressed a ferrule shaft with four double-edged blades. The ferrule is secured in place with a set screw through the nosecone and ferrule shaft. The anchoring system consists of two or three rows of outwardly curved metal strips mounted on the main body at the nose cone (proximal) end. Maximum tag weight is 300 grams (g) in air. Tag cylinders are partially coated with a broad-spectrum antibiotic (gentamicin sulfate, 2.5 g per tag) mixed with a long-dispersant methacrylate. This allows for a continual release of antibiotic into the tag site for a period of up to 5 months (Mate et al. 2007). These tags are designed to be almost completely implantable (maximum depth of 29.5 cm), except for the perpendicular stops, antenna and saltwater switch, and are ultimately shed from the whale due to hydrodynamic drag and the natural migration of foreign objects out of the tissue (Mate et al. 2007). We specifically want to deploy tags beyond the blubber/muscle interface for longer duration

attachment. We only target whales that are in good body condition (no post-cranial depression, no visible scapula, no depression along the dorsal surface of the lateral flanks).

Shorter tags of the same diameter as our current non-recoverable tag have one or two batteries instead of three, with minimum penetration depths of 20.4 cm. With fewer batteries, the latter two versions have shorter electronic lifespans than the three-battery tag using the same transmission schedule. However, battery life of the shorter tags can be prolonged by setting daily transmission limits and not transmitting every day. These shorter tags may be used on species with shallower blubber/muscle interface depths, such as Bryde's whales, with published blubber thicknesses ranging from 2.6 – 9.3 cm (Konishi et al. 2009). Our goal is to implant a tag to a depth at which the anchor petals would deploy just below the blubber-muscle interface. When held flush to the tag housing, one row of anchor petals extends to 11.4 cm from the tip of the tag's bladed nosecone. Thus we need to implant a tag at least 11.4 cm beyond the blubber-muscle interface to engage the anchors in the desired spot. With the blubber thicknesses reported above for Bryde's whales, this penetration depth would range from 14.0 – 20.7 cm.

In addition to providing transmissions for location calculation, the Wildlife Computers non-recoverable tag reports the percentage of time in user-specified temperature ranges and the percentage of the day the tag is above water. Life expectancy of the electronics of the Wildlife Computers non-recoverable tag is adjustable depending on the transmission duty cycle. With our typical baleen whale duty cycle, electronic life expectancy is 18 months. We program our sperm whale tags to last 24 months. However, tags may be shed sooner, or they may stop functioning due to electronic failure while still attached to a whale. Our tracking durations are longest for sperm whales, averaging 165 days with a maximum of 607 days. The maximum tracking duration to date for a blue whale is 513 days, with an average duration of 92.3 days. Attachment durations are shortest for humpback whales, with an average of 34.6 days and a maximum of 220 days. The Telonics non-recoverable tag generates Argos locations similar to the Wildlife Computers non-recoverable tag and also incorporates a pressure sensor and tri-axial accelerometer, so it is able to record dive depth, duration, body orientation, and motion while attached to a whale. Electronic life expectancy of Telonics non-recoverable tags is less than that of Wildlife Computers non-recoverable tags due to the extra power consumption of the additional sensors and more onboard processing time to organize the more complicated messages. We program these tags to last approximately 100 - 150 days, although we can obtain longer durations by having duty cycles that do not report daily.

The recoverable tag consists of a certified Argos transmitter and a Wildlife Computers Time-Depth Recorder (SPLASH-MK10), with a three-axis accelerometer and magnetometer, cast in an epoxy tube (2.0 cm in diameter and 11.5 cm long; Figure 6). A FastLoc® geographic positioning system (GPS) receiver, encased in syntactic foam (10.0-cm diameter dome with a maximum height of 4.0 cm), is attached to one end of the epoxy tube. Three red light-emitting diode (LED) lights are mounted on top of the syntactic foam to facilitate relocation of the tag (activated upon release of the tag from its housing). The tubular portion of the tag is slid into a cylindrical stainless steel tag housing (2.6 cm in diameter and 14.5 cm long) for deployment. A circular stainless steel plate, or collar, is welded onto the distal end of the housing to protect the syntactic foam during deployment. A penetrating tip and anchoring system, similar to that of the non-recoverable tags, is mounted onto the cylindrical end of the tag housing. The cylindrical portion of the tag housing is designed for implantation beneath the whale's skin while the plate and syntactic foam GPS receiver sit atop the whale's back. The recoverable tag and housing weigh approximately 570 g (approximately 340 g for the tag and approximately 230 g for the housing). A plastic "D-ring" is mounted on the bottom of the syntactic foam with a corrodible wire. This "D-ring" passes through a slot in the stainless steel plate and is secured on the backside of the plate with a screw. After a pre-determined, programmable time an electrical current is activated within the tag, oxidizing the corrodible wire, whereupon the tag is ejected from the housing and floats to the surface for recovery (Mate et al. 2017). To facilitate successful recovery, these tags are often programmed to release from their housings after 3-4 weeks of attachment for long-ranging species like blue whales, despite the fact that the electronic life-span of the tags is approximately 8 weeks. Our research cruises often last a month, so setting release dates for the final week of the cruise allows us to spend the end of the cruise recovering tags that have not traveled out of our vessel's range. Tags can be programmed to release after longer periods of attachment for species that have more predictable, short-range distributions within reach of day operations from shore. When a recoverable tag releases from its housing, either while still on a whale, or on the seafloor (if the housing comes off a whale prior to the tag's programmed release, both tag and housing will sink), it will float to the surface and begin transmitting every 60 seconds (compared to every 45 seconds prior to release) and the red LEDs will flash every 30 seconds. We recover the GPS locations via Argos to direct us to the vicinity of the tag and then use a directional antenna to pinpoint the tag's location. With the red LEDs we often recover tags more easily at night. Our recovery rate was 77% for tags deployed on sperm whales in the Gulf of Mexico in 2013, and also 77% for tags deployed on blue and fin whales in California in 2014 and 2015. The recoverable tags have our contact information on them which has been useful several times when beachcombers have found tags washed ashore after releasing from their housings too far offshore for us to recover. We have had people call us with these "finds" and have recovered many tags this way. For example, when two tags on sperm whales were released during a hurricane, they drifted out into the central Gulf of Mexico and were later recovered in Florida and Mexico long after their batteries were exhausted. The recoverable tags are programmed to collect a GPS-quality FastLoc® location every 7 minutes (min) or as soon thereafter as a whale surfaces from a dive. Dive depth is recorded every 1 second (s) with 2-m vertical resolution. Body orientation (from the accelerometer) and magnetic compass heading (from the magnetometer) are also recorded at 1-s intervals. These data are all archived onboard the tag and accessible when the tag is recovered. Qualifying dives (using user-programmable dive depth and duration values) are also summarized for transmission



through the Argos system along with GPS locations recorded by the tag. Three dive summary histograms are created for qualifying dives during user-programmable daily summary periods. Histograms summarize percentage of time spent at different depths (%TADHist), maximum dive depths (MaxDiveDepthHist), and maximum dive durations (DiveDurHist). Separate summary messages (behavior messages) describing individual qualifying dives are also generated by recording dive duration, maximum dive depth, dive shape (U-, V-, or square-shaped- and whether the U- or V-shaped dives were skewed right, left or centered), and the subsequent surfacing duration. Up to four consecutive summarized dives are transmitted in each behavior message. A single message from the tag can send either one GPS location, one histogram summary, or one behavior message (summarizing four dives).

Anticipated life expectancy of the recoverable tag is adjustable depending on the duty cycle, but will not nearly approach the longevity of the non-recoverable tag because of the increased energy demands of GPS acquisition, and increased hydrodynamic drag on the un-implanted portion. With continuous running we will know the precise location of every surfacing, but we expect the electronic longevity to be approximately 8 weeks. The housing itself will also ultimately be shed from the animal after a shorter period of time than for non-recoverable tags because of the additional drag on the circular plate portion. Shedding of this tag housing has been documented for 19 recoverable tags (13 on sperm whales, 4 on fin whales, 2 on blue whales) based on abrupt loss of transmissions before the tag reached the expected end of battery life, which signified the tag and its housing had come off and sunk to the seafloor. This has been confirmed in the depth record retrieved from the tag upon recovery. The attachment duration for these tags ranged from 0.7 to 34.2 d. Shedding of the recoverable tag housing has also been documented for five sperm whales that were resighted during the tagging field effort, from 4 to 59 days after tagging. An additional five sperm whales were resighted during subsequent year(s) field efforts, showing loss of tag housings from 289 to 407 days after tagging. Tag housings were likely shed much earlier than these latter resightings, however we have no information to confirm when that happened.

Future development of the recoverable tag may include the addition of a thumb-sized acoustic dosimeter which will measure received sound levels in five 5-dB ranges, each of which can be defined with different frequency bands and duration criteria. The frequency bands and duration criteria will be chosen so as to allow reception of both anthropogenic and whale-generated sounds. Like the TDR data, dosimeter data will not be relayed via Argos, but will be archived for downloading after tag recovery. The addition of a dosimeter will add approximately 2.6 cm of height to the syntactic foam dome and approximately 50 g to the total weight of the GPS tag (for a total tag plus housing weight of 620 g).

Both tag types (non-recoverable and recoverable) may be used on all species for which authorization is requested, with no more than four recoverable tags deployed per species per year. Table 2 provides a comparison of tag types (attached in the Supplemental Information section). Future non-recoverable and recoverable tags may vary slightly in terms of materials, but will not exceed the size/weight of current tags.

Animals may be tagged with a combination of a non-recoverable and a recoverable tag. Deploying two implantable tags on the same whale would offer complementary results and additional data on tag loss/failure in attachment durations. Our fully-implantable non-recoverable tags yield long term tracking information, with medium-resolution dive information, whereas the partially-implantable recoverable tag yields shorter-term (4-8 weeks) tracking with high-resolution dive information, GPS-quality locations, and future acoustic recordings capabilities. In terms of ground-truthing the detailed dive information, deploying both a non-recoverable and a recoverable tag on the same animal would provide very valuable information. We anticipate double-tagging a maximum of two whales per species per year, although logistical and financial considerations will likely prevent the achievement of this maximum in most years and for most species. Only adult whales will be candidates for double-tagging. Both tags will be deployed on the same surfacing (same tagging approach) in most cases. Rarely a second tagging approach may be necessary to deploy the second tag.

All tags utilize the Argos Data Collection and Location service, whereby the tags' ultra-high frequency (UHF) radio transmissions are received onboard NOAA TIROS-N series weather satellites. When two or more messages are received during a single pass of a satellite, a location is calculated from the Doppler shift of the transmission frequency. This information, along with modest amounts of sensor information (up to 256 bits), is sent with each transmission and is then accessible to us via computer modem. The quality of Argos locations depends upon the number of messages received during a satellite pass and the time between these transmissions, with the best accuracy being within 150 m. The recoverable tag also receives data from GPS satellites which are then used to calculate a location. This data is sent to us via the Argos-transmitted message, with location accuracy generally within 60 m.

#### Tag improvements

Gendron et al. (2015) report the breaking of a subdermal attachment from one of our tags deployed on a blue whale in 1995. The tag was an external style with two subdermal barbs for attachments (Mate et al. 2007). The subdermal attachment remained in the whale for a period of at least 9 years after tag loss and was suggested as the cause of considerable swelling at the tag

site. The authors speculated that this might have led to a reduction in reproductive rate for this whale. We have not used this style of tag since 1996, and have seen no breakage of internal tag parts, or retention of tag parts since the blue whale instance mentioned above. Two of our implantable tags have been recovered, undamaged, after being deployed on gray whales in Baja California; one was removed from a fishing net that had presumably been encountered by the tagged whale (18 days after tagging), the other was removed from a gray whale harvested in the Russian subsistence hunt (202 days after tagging).

Other tagging researchers have documented breakage with implantable tags on humpback whales (Robbins et al. 2013), in which articulating subdermal anchors had broken from the main part of the tag and remained in the whale after tag loss. Our tag design is markedly different than that style, with a fully-rigid design and no articulating anchors. To provide even more structural integrity, our anchor petal design has been modified to a "cupped" sleeve that is fully captured by the tag housing, rather than our initial design of an open sleeve that was held in place by set screws (left and right in Figure 7, respectively). The petals are cut from a single piece of stainless steel and are much less likely to break off compared to welded petals (Szesciorka et al. 2016).

We have seen breakage in one of our tags that struck a whale at an oblique angle and bounced back in the boat rather than deploying properly. The Delrin nosecone in which the blades were fastened was broken in this case. We don't anticipate breakage of this kind with deployed tags. Our bladed cutting tip consists of a commercial hunting broadhead, with four blades captured along their entire length in a grooved metal ferrule. This broadhead is pressed into our Delrin nosecone and secured in place with a set screw through the nosecone and ferrule (Figure 8). Additionally, the Delrin nosecone used in our current tags is much thicker than the one used in the broken nosecone described above.

We have also seen breakage in antenna endcaps on four of our tags (in 2009-2013), with one or both of two plastic "stops" breaking off on deployment. These "stops" are external tag components that prevent tags from embedding beyond the antenna endcap, and their breakage does not contribute to tag parts being retained in the whale. In all cases these breakages had no effect on tag performance, with tags transmitting from 133 to 338 days. We have not used plastic endcaps since 2013, having switched to stainless steel (in the case of Wildlife Computers tags) and polycarbonate "stops" (in the case of Telonics tags). We have seen no breakage in these newer materials.

In 2009, we resighted a tagged gray whale with a broken/missing antenna endcap 39 days after tagging. Two tagged sperm whales were resighted with broken tags, in which the Delrin "stops", antennae, and salt-water switch posts were all missing; one whale tagged in 2010 and resighted 3 years after tagging, one whale tagged in 2011 and resighted 403 days after tagging. We don't know what caused these breakages and the tags were no longer functional. In 2017 we resighted (or were sent photographs of) three tagged humpback whales with broken antennas. These antennas were made of a single strand nitinol cable, which is considered quite flexible with good memory (capable of withstanding significant bending and returning to its original orientation). We suspect whale-to-whale contact is responsible for these breakages. After consultation with the tag manufacturer (Telonics) we will be switching to a multi-stranded cable for future tags. These will be more flexible than a single strand cable and less susceptible to breakage from whale-to-whale contact.

### Biopsy Sampling

Skin and blubber samples may be taken as biopsies or sloughed skin from each tagged whale, for sex and reproductive condition determination, genetic analysis, stable isotope analysis, toxicology, and lipid content. Previously-tagged whales may be biopsy-sampled in subsequent encounters (subsequent field seasons) for post-tag monitoring (pregnancy and health assessment). Biopsy sampling of previously-tagged whales may occur up to two times annually (but not during the same month). We will also biopsy up to 20 non-tagged whales per tagged species annually for additional stock structure analyses.

Biopsy samples will primarily be collected through the deployment of a biopsy dart from a 120 lb recurve crossbow at distances typically no closer than 5 m (if a biopsy is not obtained during the tagging approach). No more than three attempts to collect a biopsy sample will be conducted per day. The crossbow deployment system was recommended to us by other researchers experienced in biopsy sample collection (Howard Rosenbaum, American Museum of Natural History; Dan Engelhaupt, HDR Inc.; Jorge Urban, Universidad Autónoma de Baja California Sur; and Mads Peter Heide-Jørgensen, Greenland Institute of Natural Resources) and has proven very successful. No other deployment methods are being considered at this time. Ideally, the biopsy will be obtained during the same surfacing as the tag deployment. If we are unsuccessful in obtaining a biopsy sample during tag deployment, the tagged whale may be approached again to obtain a biopsy. The biopsy consists of a small plug of tissue (6 mm x 40 mm) from the whale's back using a dart with a sterilized coring tip (both dart and coring tip come from Ceta-Dart, a Danish company owned by Finn Larsen). The coring tips are heat sterilized (flamed) to remove pathogens and genetic material with a butane or propane torch for 30 seconds before being attached to the dart, and then wrapped in tin foil prior to being placed in the crossbow. Used biopsy tips are cleaned with soap and water and heat sterilized again prior to re-use. Surgical gloves are worn during

these procedures. The dart is free-floating and is retrieved immediately after sampling. Additional samples of sloughed skin may be collected from the water with a dip net when single whales are approached and tagged. However, such samples are often not useful for some species (e.g. sperm whales) as the DNA in sloughed skin has deteriorated. Samples are preserved in vials containing ethanol and labeled with the date and location of collection, tag number, species name, age class, and sex, if known. At the conclusion of each field season, samples are sent for analysis to laboratories (such as OSU Marine Mammal Institute's Cetacean Conservation Genetics Laboratory, under the direction of Scott Baker) specializing in genetic techniques appropriate for each species. Sometimes samples will be shared with collaborators who have other institutional needs.

#### Photography and Photo-identification

Still photographs and video footage will be taken for individual whale identification and for documentation of tag deployment and attachment. Digital SLR cameras with telephoto lenses (up to 300 mm) will be used for still photography. Digital video cameras with high shutter speed capability ( $>1/1000$  of a second) will be used for video documentation. All images will be labeled with the date and location of collection, tag number, species name, age class and sex, and stored on computers as well as back-up external hard drives. Identification photographs will be shared with collaborators maintaining identification catalogues for those species. The optimal approach distance for photographic identification is from 10-15 m. If a whale is suspected to have been previously tagged (by having a scar in a position where we typically attach tags), we may approach as close as 5 m to adequately document wound healing.

#### Aerial surveys

Aerial survey flights may be required at times to locate whales more efficiently than by boat. Flights will typically be flown at 300 m using either single or twin-engine light aircraft. The aircraft may fly as low as 150 m at times to determine whether a whale has a tag. If the aircraft is attempting to guide our tagging boat to an animal, particularly in the case of follow-up observations of tagged whales, it may circle over an individual or group of whales for up to an hour at an altitude of 300 m or higher, if the boat is not in the immediate vicinity.

#### Prey Sampling and Acoustics

Prey species and abundance may be assessed with the use of echosounders, towed nets or optical plankton counters. Echosounders may be single or split-beam, using 38 kHz, 70 kHz, and 120 kHz signals with pulse durations ranging from 0.06 – 4.10 ms. Received levels of sound will be  $<180$  dB re  $1 \mu\text{Pa}$  at 1 m (rms). In the case of towed nets, we may use bongo nets or small otter trawls to sample prey in the vicinity of whales, but these would be small and not pose an entanglement risk for the whales. They would be deployed with a winch off the tagging boat or off the back deck of the larger support vessel, within 50-100 m of a feeding whale.

Towed acoustic arrays and hand-held directional hydrophones may also be used occasionally in the passive detection of whales and to record whale vocalizations. Towed arrays may reach lengths up to 400 m and may be towed at depths up to 600 m.

#### Seasonality of tagging

Our proposed activities will take place during both reproductive (breeding and calving) and feeding seasons of the requested species for both logistical and scientific reasons. During these times, animals may be temporally and spatially concentrated and thus provide good tagging opportunities. Information about movements, timing, and behavior during the reproductive, migration and feeding seasons is critical for the successful protection and management of each species. The deployment of long-term satellite tags during the breeding/calving season and tracking animals as they migrate to their feeding destination (or vice-versa) may be the only way to discover and protect critical habitats.

#### Follow-up monitoring of tagged whales

During the course of our field operations we make concerted efforts to photographically identify not only the whales we tag, but all of the whales we encounter. Thus with subsequent field efforts we have opportunities to photographically "recapture" whales that have been tagged before. We specifically look for wounds or scars on animals and make extra effort to photograph these if they represent potential tag sites. Body condition and tag site condition is noted for animals suspected or known to have been previously tagged.

Following our first season of tagging eastern North Pacific blue whales in California in 1993, we have conducted subsequent field studies with this population for an additional 15 years. After our first season of tagging sperm whales in the Gulf of Mexico in 2001, we conducted subsequent studies with this population for an additional 8 years. We conducted three years of tagging

studies on the Pacific Coast Feeding Group of gray whales off the coast of Oregon and California. We conducted three years of tagging on humpback whales in Southeast Alaska, and eight years of tagging on humpback whales in Hawaii. In addition to the subsequent tagging field efforts, we have conducted dedicated follow-up studies of tagged whales, in which photographic "recapture" was the objective and no tagging was undertaken. This included one study of tagged sperm whales in the Gulf of Mexico, two studies of tagged sperm whales in the Gulf of California, and 16 such efforts of tagged gray whales off Oregon and California. The results of our own follow-up studies have been presented at the Society for Marine Mammalogy Biennial Conferences (Hayslip et al. 2009, 2011, 2013, 2015, 2017) and in Mate et al. (2007).

We also work collaboratively with other permit holders to facilitate follow-up studies of tagged whales. In this regard, we provide researchers with photographs of tagged whales for identification purposes and provide tag deployment information (tagging dates, tag placement details) to local stranding networks so that stranded whales can be examined for tags or tag wounds. We also provide current Argos locations of tagged whales to other permitted researchers during their field efforts with the same population to help them find whales for their own purposes and to facilitate post-tag monitoring. The results of such post-tag monitoring in collaboration with other researchers have been published for southern right whales, blue whales, and gray whales (Best and Mate 2007, Best et al. 2015, Gendron et al. 2015, Norman et al. 2017).

Additionally, we have contributed identification photos of tagged humpback whales from 2004 to present to the website "HappyWhale" to facilitate resightings of these whales. This website has over 88,000 submitted photos in their catalog, representing over 12,000 individual humpback whales. We are notified when a submission of ours is matched with their catalog and can view the matching photographs (primarily fluke photos) as well as obtain information regarding the time and general location in which the whale had been sighted and the photographer's name. As most of the photographs from other contributors to HappyWhale are of flukes, these matches provide us with resight information (time and location), but not body condition or wound healing information. When matches are found we will contact contributors to see if they have additional photographs which show the animal's body and tag site to assess wound healing and body condition.

Opportunistic species

Other species will not be directly affected by our tagging activities. However, we are requesting authorization to conduct non-invasive Level B harassment to approach, photograph, and observe non-target marine mammals (including pinnipeds) encountered during the course of our field efforts. These situations provide opportunities to contribute to the knowledge of species for which little information has been documented, or to document injuries or entanglements. We are requesting authorization to approach the species listed in the Take Table and Table 3 (see attached Supplemental Information section) to enhance photographic identification catalogues, species' range and behavioral information, and suspected anthropogenic impacts, using the same methods described above for photo-identification. These approaches would typically occur at ranges of 10 m or greater, but may require closer approaches to adequately assess an entanglement.

For import and export activities

Our requested activities include the tagging of whales in international waters. During the 5-year period of this permit, we may also conduct tagging projects in foreign countries, under authority of foreign permits issued to us or our collaborators in those countries. Both situations may result in the need to import biopsy samples into the United States (numbers not to exceed the number of whales tagged in those research projects). In both cases, biopsy samples will be obtained from tagged whales with a remotely-deployed dart in the same manner described above in this permit application. Biopsy samples will be stored in sealed vials containing ethanol, and labeled with the date and location of collection, tag number, species name, age class, and sex, if known. Samples will be hand-carried into the U.S. by research staff at the conclusion of the field season, or will be mailed into the country. Biopsy samples will be sent for analysis to laboratories specializing in genetic techniques appropriate for cetaceans (such as OSU Marine Mammal Institute's Cetacean Conservation Genetics Laboratory, under the direction of Scott Baker). If our analytical needs could not be met by a genetics laboratory in the U.S. we request authorization to export (and re-export samples that have been imported) biopsy samples to appropriate laboratories in foreign countries. CITES import, export, or introduction from the sea permits will be obtained as required.

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Supplemental Information

Status of Species: See Table 4 in the Supplemental Information section for Status of the Affected Species.

**Intentional Lethal Take:**

The proposed activities do not involve intentional or unintentional lethal takes. No known mortality has occurred in previous tagging operations and none is expected in future ones. There is also no known subsequent change in mortality rates for tagged whales. For instance, the resighting rate of tagged versus untagged North Atlantic right whales (Kraus et al. 2000) and southern right whales is identical (Best and Mate 2007). Mizroch et al. (2011) document the long-term survival (20-30 years) of seven humpback whales radio-tagged from 1976 through 1978. Walker et al. (2012), in their review of studies addressing tagging impacts on marine mammals, found that no studies designed to look at survival demonstrated reduced life expectancy as a result of tagging.

**Anticipated Effects on Animals:**

**Behavioral Responses**

We have observed no responses to our aerial observations/surveys. The behavioral effects of our vessel activities on individual animals consist primarily of short-term startle responses, including quick dives, tail flicks, head lifts, fluke lifts, fluke slaps, rolling, and defecation, and combinations of these responses. Reactions occur in response to tag deployment, biopsy sampling, and/or to the close boat approach necessary for such activities (from within 1-4.5 m of target animals, for tagging). Approximately 50% of all whales tagged during the years 2005-2017 reacted to the tagging process. There were striking differences in response rates between species, with sperm whales reacting most often (82% of tag deployments) compared to 74% for gray whales, 64% for humpbacks, and 18% for both blue and fin whales. In our work, biopsy sampling most often takes place on the same surfacing as for tagging, immediately after the tag has been launched from the applicator. In such cases, responses to biopsy collection cannot be distinguished from responses to tagging. Reactions to biopsy darting alone have been reported in the literature as generally mild and most commonly consisted of "startle" responses (Whitehead et al. 1990, Brown et al. 1991, Weinrich et al. 1991, Barrett-Lennard et al. 1996, Weller et al. 1997, Hooker et al. 2001). During 2007-2017 we have collected 11 biopsy samples on subsequent surfacings (after tagging) at distances ranging from 5-15 m (6 blue whales, 1 fin whale, 2 humpback whales, 2 sperm whales). One blue whale exhibited a slight flinch upon biopsy darting. Both humpback whales responded to the darting, one with a mild tail flick and the other with a fluke lift. No other whales responded to the biopsy darting.

**Physical Impacts**

We have seen no physical impacts from biopsy darting. No wounds or scars have been observed.

Following tagging, there is a great deal of variation in the wound healing process, making the evaluation of possible physical effects of tagging on whales complicated. Only consistent, well-documented and long-term follow-up can provide conclusive results, but such studies are costly and logistically difficult for cosmopolitan or wide-ranging species that can travel more than 100 km/day. Relocation of tagged whales is further complicated by discontinuous data transmission schedules for the conservation of battery power in long-term tracking and errors associated with satellite tag locations limiting the number of accurate locations received each day. The possibility of locating open-ocean species that can wander over areas of 40 degrees of latitude (and up to 1,000 miles from shore) is almost impossible once the tags stop transmitting. Even for species occurring in predictable nearshore areas, follow-up monitoring can be quite difficult. For populations with large numbers, the ratio of tagged whales to untagged whales can be quite low, reducing the probability of resighting a tagged whale during follow-up efforts (or subsequent field seasons, when perhaps <10% of the stock may be encountered). Additionally, tag scars, if any, are often quite inconspicuous and easy to miss.

Even tags themselves can be difficult to see at a distance, and therefore close approaches are often necessary for the evaluation of wound healing, a process often complicated by adverse weather conditions at sea. We have attempted to re-locate tagged gray whales with shore-based observers (using direction finders) working in conjunction with photographers in small boats and in one case, knew that we were "close" to the tagged whale in a dispersed group of 10 whales, but still could not spot the tagged whale. However, upon return to the lab we were able to spot the tag in the photographs taken that day. This has happened multiple times for us. Despite these difficulties, over 100 of our tagged whales have been sighted to date (out of 752 whales satellite-tagged between 1986 and 2016), either through opportunistic observations or planned follow-up studies, over periods of up to 19 years after tagging (Best and Mate 2007, Hayslip et al. 2009, 2011, 2013, Best et al. 2015, Calambokidis et al. 2015, Norman et al. 2017). None of the animals were emaciated or had higher than normal external parasite loads, and they behaved similarly to other untagged whales in the area when re-sighted.

Observations from our tagging of whales from 1988 to 2017 shows the condition of tag sites to vary among animals. Tissue extrusion (white, pale yellow, or beige) was seen around the tag for 5 of 31 resighted blue whales (2-120 days after tagging), 2 of 24 resighted sperm whales (17 and 281 days after tagging), and 1 of 31 resighted gray whales (12 days after tagging).

In some cases, swelling developed around the tag site after tag deployment, either localized (extending 3-15 cm around the tag) or regional (30-60 cm around the tag), but, when re-sighted, most of these cases have shown considerable improvement or complete healing in the species for which follow-up has been possible (right whales, sperm whales, gray whales, blue whales) (Best and Mate 2007, Hayslip et al. 2009, 2011, 2013, Best et al. 2015, Norman et al. 2017). For others, swelling remained unchanged from the first resighting. In most cases, swelling appears to be short-term and is not viewed as life threatening (J. Geraci, pers. comm. 2000, Gendron et al. 2015). Four of nine resighted North Atlantic right whales had swelling (two localized and two regional) around their tag sites (Mate et al. 2007). After one year, only one of these animals still had swelling. Five of 39 resighted sperm whales had swelling (four localized and two regional) around their tag sites. The two regional swellings were observed 281 and 289 days after tagging. The localized swellings around the tag sites were observed from 213-350 days after tagging. One of 15 resighted southern right whales had slight localized swelling around the tag site one year after tagging. Twenty-one of 63 resighted blue whales had swelling around the tag sites, ranging from 30 days to 11 years post-tagging (Norman et al. 2017). The most persistent high-grade swellings (broad area affected or width/length greater than height of dorsal ridge/fin) were observed in two of these blue whales tagged between 1993 and 1995 and were likely due to retention of a broken subdermal tag attachment rod of early external tag types that are no longer used. Twenty-five of 34 resighted gray whales had swelling around the tag site, observed as early as 11 days post-tagging, but these resolved over time (mean time from initial observation of the wound to absence of swelling or the presence of a low depression (scar) was a little over a year (Norman et al. 2017). Veterinary opinion is mixed about whether swelling is due to infection or a foreign body response (with the latter explanation prevailing). In all but one of the resighting cases mentioned, the whales appeared to be in good health (not noticeably underweight) and behaved "normally" according to observers' reports. One recent study, however, suggested that swelling associated with long-term retention of attachment material from an earlier-style tag may have resulted in an apparently reduced reproductive rate in the case of a blue whale (Gendron et al. 2015). Following the extrusion of the attachment material in this case, the swelling disappeared and the whale was subsequently resighted with a new calf two years later, 16 years after tagging. However, Gendron et al. clearly states that the whale wasn't observed in the Gulf of California in 6 years during that period (1997, 1998, 1999, 2001, 2008, and 2010). It could have had a calf in any of those years, although not as likely in 1997 and 2010. The paper also does not adequately address their photographic effort, saying that they have only 3-6 days of field effort between Jan-May each year, without mentioning the dates of sighting for the whale with the swelling. We have no way of knowing whether the whale was only sighted on one day in early January in a particular year and hadn't given birth yet.

Scars observed after tag loss consist of either a white or fully re-pigmented divot at the tag site (1-2 cm deep by 4-15 cm diameter) (Best and Mate 2007, Hayslip et al. 2009, 2011, 2013, Best et al. 2015, Norman et al. 2017). This has been observed in gray whales (up to 19 years after tagging), North Atlantic right whales (from 16 days to 2 years after tag loss), southern right whales (up to 11 years after tagging), humpback whales (ranging from 4 to 35 days after tag loss), and sperm whales (3 to 14 months after tagging). Additionally, in some gray whale cases, there was also skin sloughage and cyamids (whale lice) at the tag sites.

While the positive contributions of tagging studies are undeniable, the potential for negative impacts associated with the implantation of satellite tags in large whales cannot be discounted. According to Walker et al. (2012), in addition to behavioral responses, these may include physiological responses, injury and disease, changes in survival rates, and changes in reproduction and growth. Other researchers have expressed concern about the potential for and the level of pain felt by a whale swimming with an implanted tag for extended periods of time (Moore et al. 2013), and whether this may impede its natural behaviors in a significant way (Walker et al. 2012). There are currently no means of assessing discomfort or pain associated with tag retention for free-ranging cetaceans (Best et al. 2015). In their review of studies addressing tagging impacts on marine mammals, Walker et al. (2012) reported that research has primarily focused on short-term behavioral responses, with few addressing effects of tagging on reproduction or growth, and fewer still addressing short-term pain caused by tagging. In this same review, all studies looking at short-term physiological changes (e.g. increased acute-phase proteins) reported measurable effects, but no studies designed to look at survival demonstrated reduced life expectancy as a result of tagging (Walker et al. 2012). Since the Walker et al. (2012) review, additional studies addressing tagging impacts have been published. Using photo-identification methods, Mizroch et al. (2011) demonstrated the long-term survival (20-30 years) of seven humpback whales radio-tagged from 1976 through 1978. Robbins et al. (2013) detected no significant effect on reproductive rate for satellite-tagged humpback whales, with females tagged in 2011 returning with calves in 2012 as frequently as untagged females that were also present during tagging. Subsequent observations of these humpback whales suggested reduced reproductive rates for some tagged animals, but it had not been determined whether this was due to retention of broken tag parts after tags had fallen off or due to tagging in general (Zerbini et al. 2017). Best et al. (2015) showed that the reproductive rates of tagged southern right whales were similar to that of untagged whales, and unchanged from their pre-tagging reproductive history, using photographic resights of tagged whales up to 11 years after tagging. In an examination of the sighting histories of 29 of our tagged gray whales and 85 of our tagged blue whales, Calambokidis et al. (2016) showed no evidence of a survival effect between tagged and untagged blue whales, and a small, but not statistically significant reduction in survival of tagged versus untagged gray whales. The gray whale result was primarily driven by the lack of resighting during the study period of two tagged gray

whales and the death of a third gray whale from undetermined causes. Since the reporting of the former results, one of the two non-resighted gray whales in the Calambokidis et al. (2016) examination was resighted alive in 2017 off the Pacific Northwest coast (J. Calambokidis, pers. comm., 2017).

The fate of tagged whales that are not resighted after their tracking period cannot be determined. Tracking results suggest that tagging does not significantly alter the behavior of tagged whales. Re-sighted tagged whales are often in the presence of untagged whales, suggesting that the movements and habitat choices of tagged whales are similar to untagged whales. Additionally, the tracking of species to known (as well as previously unknown) areas of concentration (Baumgartner and Mate 2005, Lagerquist et al. 2008, Bailey et al. 2009, Mate et al. 2011, Rosenbaum et al. 2014) using recognized migration corridors (Mate and Urbán 2003) and characteristic travel speeds (Lagerquist et al. 2008), including historical areas of sightings and whaling catch records (Zerbini et al. 2006, Double et al. 2014), indicate that the long-term movements of tagged whales are consistent with non-tagged whales.

**Measures to  
Minimize Effects:**

Satellite tagging is the only means of obtaining long-term movement and dive information on free-ranging cetaceans. We believe the benefits obtained through such research outweigh the costs of minimal stress and/or pain. Although tag electronics may be further miniaturized, the depth of deployment is based on veterinarian recommendations (Mate et al. 2007) to assure attachment involving the blubber-muscle interface for improved retention and better response to potential infections due to increased blood (white cell) circulation. None of our tags have the potential to penetrate deep enough to result in injury to vital organs. Our tags are always applied high up on the whale's back, close to the dorsal midline (90 percent of our implantable tags have been deployed within 25 cm of the midline, with a median of approximately 13 cm from the midline, for 431 tags), and at those locations do not extend below the vertebral processes. As all of the vital organs are located ventrally, below the vertebrae, there is no possibility of a tag penetrating them.

Long-dispersant antibiotic will be applied to the subdermal portions of tags and tags will be gas sterilized to reduce risk of infection. Tags will remain sealed in their sterilization bags until they are in the field and ready to be placed in the ARTS applicator for deployment. Our procedures have been approved by marine mammal veterinarians, and our Institutional Animal Care and Use Committee (see attached IACUC permit in Supplemental Information section). Our techniques have been reviewed by workshops on large whale tagging (Weller 2008) and large whale tag attachments (ONR). We participated in the Tagging Best Practices workshop held in Washington, D.C. in September 2017, both in providing recommendations for tagging and in adopting the recommendations of other labs for minimizing impacts to whales. The latter recommendations include the disinfection of tags (soaking the tips/attachments in 99% isopropyl alcohol for 30 seconds) that have been removed from their gas sterilization bags and spend time in the ARTS applicator but are not deployed. Biopsy darts are heat sterilized (flamed) prior to use, including darts that miss their target and enter the water.

When approaching animals some disturbance is unavoidable. This typically involves a change in swim direction as animals try to avoid the tagging boat. This may also include aerial displays (breaching, head-slapping) to aerial observations. Close boat approaches and aerial surveys will be undertaken with care so as not to unduly stress the animals. Approaches to animals (either in a boat or from the air) will be terminated if animals exhibit "acute behavioral response" (repeated, prolonged, or excessive instances of disturbance or disruption of normal behavior patterns).

While attempting to tag mothers with calves, care will be taken not to separate or stress the mother/calf pair. At no time will our vessel purposefully maneuver between a mother and calf, and we will terminate efforts if there is any evidence that our activity is interfering with pair-bonding or nursing. Our experience tagging and resighting tagged mothers with calves within the same season gives us confidence that our approach protocols do not disrupt the mother/calf relationship.

When conducting net tows for prey sampling, we will conduct visual observations from the towing vessel to ensure protected species (including turtles) do not come in contact with the nets. We will be using small (up to 60 cm diameter) Bongo nets that will be easy to recover if protected species are observed near the nets and at risk of injury.

To minimize disturbance to target animals, we coordinate our permitted research activities with other permit holders by notifying appropriate NMFS regional offices of our upcoming work prior to any field season. Additionally, we often collaborate directly with local area experts during our field efforts. For example, we worked directly with Dr. Peter Best in South Africa to study southern right whales, with Dr. Howard Rosenbaum in Gabon to study humpback whales, and with Dr. Jorge Urban in Baja California to study blue, fin, humpback, gray, and sperm whales. If not working directly with other researchers, we communicate with other researchers in the area to share whale locations as well as the timing and location of our research efforts, as has been the case with our work in southern California in which we communicated closely with Brandon Southall, Greg Schorr and John Calambokidis during

their Behavioral Response Studies.

**Resources Needed to Accomplish Objectives:** Dr. Bruce Mate, Director of OSU's Marine Mammal Institute (OSUMMI), has been working in the marine mammal field for 46 years and is highly qualified to successfully accomplish the objectives in this application. He has pioneered the use of satellite telemetry for large whales and has provided significant results for 7 species of whales from the Arctic to the Antarctic. He has had funding from the Office of Naval Research (ONR), Minerals Management Service (now the Bureau of Energy Management, BOEM), the International Whaling Commission (IWC), the National Marine Fisheries Service (NMFS), the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), the Joint Industry Program (JIP), the International Association of Geophysical Contractors (IAGC), British Petroleum, and Exxonmobile.

The resources, including vessels and physical supplies necessary for our tagging studies, belong to the OSU Marine Mammal Institute's Whale Telemetry Group and will remain with the group when Dr. Bruce Mate retires. Current funding sources include the U.S. Navy, through their Cooperative Ecosystem Studies Unit and through HDR Inc.

**Disposition of Tissues:** Biopsy samples will be stored in Dr. Scott Baker's Cetacean Conservation and Genomics Laboratory (CCGL) at the OSUMMI.

**Public Availability of Product/Publications:** Research results will be made available to the public through publication in peer-reviewed scientific journals and through the preparation of contract reports, as well as through presentations at scientific conferences and in public education forums.

Location/Take Information

Location

Research Area: Worldwide State: NA

Location Description: All U.S. territorial waters and international waters worldwide.

Take Information

| Line | Ver | Species                       | Listing Unit/Stock | Production /Origin | Life Stage | Sex             | Expected Take | Takes Per Animal | Take Action | Observe /Collect Method | Procedure   | Transport Record | Begin Date | End Date   |
|------|-----|-------------------------------|--------------------|--------------------|------------|-----------------|---------------|------------------|-------------|-------------------------|---|------------------|------------|------------|
| 1    |     | Dolphin, Atlantic spotted     | Range-wide         | Wild               | All        | Male and Female | 50            | 1                | Harass      | Survey, aerial/vessel   | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A              | 12/20/2018 | 12/31/2023 |
| 2    |     | Dolphin, Atlantic white-sided | Range-wide         | Wild               | All        | Male and Female | 1000          | 1                | Harass      | Survey, aerial/vessel   | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A              | 12/20/2018 | 12/31/2023 |



|   |  |                               |            |      |     |                 |      |   |        |                       |   |     |            |            |
|---|--|-------------------------------|------------|------|-----|-----------------|------|---|--------|-----------------------|---|-----|------------|------------|
| 3 |  | Dolphin, bottlenose           | Range-wide | Wild | All | Male and Female | 500  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 4 |  | Dolphin, clymene              | Range-wide | Wild | All | Male and Female | 500  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 5 |  | Dolphin, common, long-beaked  | Range-wide | Wild | All | Male and Female | 1000 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 6 |  | Dolphin, common, short-beaked | Range-wide | Wild | All | Male and Female | 1000 | 1 | Harass | Survey, aerial        | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 7 |  | Dolphin, Fraser's             | Range-wide | Wild | All | Male and Female | 1000 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 8 |  | Dolphin, northern right whale | Range-wide | Wild | All | Male and Female | 3000 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations,  | N/A | 12/20/2018 | 12/31/2023 |

|    |  |                                    |            |      |     |                       |      |   |        |                          |   |     |            |            |
|----|--|------------------------------------|------------|------|-----|-----------------------|------|---|--------|--------------------------|---|-----|------------|------------|
|    |  |                                    |            |      |     |                       |      |   |        |                          | behavioral; Photo-id;<br>Photograph/Video   |     |            |            |
| 9  |  | Dolphin,<br>Pacific<br>white-sided | Range-wide | Wild | All | Male<br>and<br>Female | 2000 | 1 | Harass | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Incidental<br>harassment; Observation,<br>monitoring;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 10 |  | Dolphin,<br>pantropical<br>spotted | Range-wide | Wild | All | Male<br>and<br>Female | 3000 | 1 | Harass | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Incidental<br>harassment; Observation,<br>monitoring;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 11 |  | Dolphin,<br>Risso's                | Range-wide | Wild | All | Male<br>and<br>Female | 150  | 1 | Harass | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Incidental<br>harassment; Observation,<br>monitoring;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 12 |  | Dolphin,<br>rough-toothed          | Range-wide | Wild | All | Male<br>and<br>Female | 200  | 1 | Harass | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Incidental<br>harassment; Observation,<br>monitoring;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 13 |  | Dolphin,<br>spinner                | Range-wide | Wild | All | Male<br>and<br>Female | 1000 | 1 | Harass | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Incidental<br>harassment; Observation,<br>monitoring;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |

|    |  |                       |            |      |     |                 |      |   |        |                       |   |     |            |            |
|----|--|-----------------------|------------|------|-----|-----------------|------|---|--------|-----------------------|---|-----|------------|------------|
| 14 |  | Dolphin, striped      | Range-wide | Wild | All | Male and Female | 3000 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 15 |  | Dolphin, white-beaked | Range-wide | Wild | All | Male and Female | 1000 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 16 |  | Narwhal               | Range-wide | Wild | All | Male and Female | 400  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 17 |  | Porpoise, Dall's      | Range-wide | Wild | All | Male and Female | 100  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 18 |  | Porpoise, harbor      | Range-wide | Wild | All | Male and Female | 100  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 19 |  | Sea lion, California  | Range-wide | Wild | All | Male and Female | 200  | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |

|    |  |                     |   |      |     |                 |      |   |        |                |   |     |            |            |
|----|--|---------------------|---|------|-----|-----------------|------|---|--------|----------------|---|-----|------------|------------|
| 20 |  | Sea lion, Steller   | Range-wide (NMFS Endangered/Threatened) | Wild | All | Male and Female | 40   | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 21 |  | Seal, bearded       | Range-wide                              | Wild | All | Male and Female | 20   | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 22 |  | Seal, gray          | Range-wide                              | Wild | All | Male and Female | 20   | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 23 |  | Seal, Guadalupe fur | Range-wide                              | Wild | All | Male and Female | 100  | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 24 |  | Seal, harbor        | Range-wide                              | Wild | All | Male and Female | 1000 | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 25 |  | Seal, harp          | Range-wide                              | Wild | All | Male and Female | 100  | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 26 |  | Seal, Hawaiian monk | Hawaiian Islands (NMFS Endangered)      | Wild | All | Male and Female | 100  | 1 | Harass | Survey, vessel | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |

|    |  |                         |            |      |     |                 |     |   |        |                       |   |     |            |            |
|----|--|-------------------------|------------|------|-----|-----------------|-----|---|--------|-----------------------|---|-----|------------|------------|
| 27 |  | Seal, hooded            | Range-wide | Wild | All | Male and Female | 100 | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |
| 28 |  | Seal, northern elephant | Range-wide | Wild | All | Male and Female | 200 | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |
| 29 |  | Seal, Northern fur      | Range-wide | Wild | All | Male and Female | 200 | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |
| 30 |  | Seal, ribbon            | Range-wide | Wild | All | Male and Female | 20  | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |
| 31 |  | Seal, ringed            | Range-wide | Wild | All | Male and Female | 20  | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |
| 32 |  | Seal, spotted           | Range-wide | Wild | All | Male and Female | 20  | 1 | Harass | Survey, vessel        | Incidental disturbance; Observation, monitoring; Observations, behavioral; Photograph/Video                                       | N/A | 12/20/2018 | 12/31/2023 |
| 33 |  | Whale, Baird's beaked   | Range-wide | Wild | All | Male and Female | 50  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |

|   |  |                            |                              |      |             |                 |     |    |                 |                       |  |     |            |            |
|---|--|----------------------------|------------------------------|------|-------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
| 34  |  | Whale, beluga              | Range-wide                   | Wild | All         | Male and Female | 400 | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 35  |  | Whale, Blainville's beaked | Range-wide                   | Wild | All         | Male and Female | 12  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 36  |  | Whale, blue                | Range-wide (NMFS Endangered) | Wild | Non-neonate | Male and Female | 48  | 4  | Harass/Sampling | Survey, vessel        | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Only one tag per individual per year.   |  |                            |                              |      |             |                 |     |    |                 |                       |  |     |            |            |
| 37  |  | Whale, blue                | Range-wide (NMFS Endangered) | Wild | All         | Male and Female | 300 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |                            |                              |      |             |                 |     |    |                 |                       |  |     |            |            |
| 38  |  | Whale, blue                | Range-wide (NMFS Endangered) | Wild | Adult       | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video;  | N/A | 12/20/2018 | 12/31/2023 |

|   |  |                |                              |      |             |                 |     |    |                 |                       |  |     |            |            |
|---|--|----------------|------------------------------|------|-------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
|   |  |                |                              |      |             |                 |     |    |                 |                       | Sample, skin and blubber biopsy  |     |            |            |
| 39  |  | Whale, blue    | Range-wide (NMFS Endangered) | Wild | Non-neonate | Male and Female | 2   | 4  | Harass/Sampling | Survey, aerial/vessel | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Up to 2 individuals may receive 2 tag types per year.                                     |  |                |                              |      |             |                 |     |    |                 |                       |  |     |            |            |
| 40  |  | Whale, bowhead | Range-wide (NMFS Endangered) | Wild | All         | Male and Female | 50  | 1  | Harass          | Survey, vessel        | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 41  |  | Whale, Bryde's | Range-wide                   | Wild | Adult       | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy  | N/A | 12/20/2018 | 12/31/2023 |
| 42  |  | Whale, Bryde's | Range-wide                   | Wild | All         | Male and Female | 200 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |                |                              |      |             |                 |     |    |                 |                       |  |     |            |            |

|    |  |                              |            |      |     |                 |     |   |        |                       |   |     |            |            |
|----|--|------------------------------|------------|------|-----|-----------------|-----|---|--------|-----------------------|---|-----|------------|------------|
| 43 |  | Whale, Cuvier's beaked       | Range-wide | Wild | All | Male and Female | 25  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 44 |  | Whale, Deraniyagala's beaked | Range-wide | Wild | All | Male and Female | 5   | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 45 |  | Whale, dwarf sperm           | Range-wide | Wild | All | Male and Female | 10  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 46 |  | Whale, Eden's                | Range-wide | Wild | All | Male and Female | 10  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 47 |  | Whale, false killer          | Range-wide | Wild | All | Male and Female | 300 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
|    |  |                              |            |      |     | Male            |     |   |        |                       | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive,                     |     |            |            |



|   |  |            |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
|---|--|------------|------------------------------|------|----------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
| 48  |  | Whale, fin | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 48  | 4  | Harass/Sampling | Survey, vessel        | parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy   | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Only one tag per individual per year.   |  |            |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 49  |  | Whale, fin | Range-wide (NMFS Endangered) | Wild | Adult          | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy  | N/A | 12/20/2018 | 12/31/2023 |
| 50  |  | Whale, fin | Range-wide (NMFS Endangered) | Wild | All            | Male and Female | 300 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |            |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 51  |  | Whale, fin | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 2   | 4  | Harass/Sampling | Survey, aerial/vessel | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Up to 2 individuals may receive 2 tag types per year.                                     |  |            |                              |      |                |                 |     |    |                 |                       |  |     |            |            |

|   |  |                              |                               |      |                |                 |     |    |                 |                       |  |     |            |            |
|---|--|------------------------------|-------------------------------|------|----------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
| 52  |  | Whale, Gervais' beaked       | Northern Gulf of Mexico Stock | Wild | All            | Male and Female | 10  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 53  |  | Whale, ginkgo-toothed beaked | Range-wide                    | Wild | All            | Male and Female | 10  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 54  |  | Whale, gray                  | Eastern North Pacific         | Wild | Adult/Juvenile | Male and Female | 48  | 4  | Harass/Sampling | Survey, vessel        | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Only one tag per individual per year. |  |                              |                               |      |                |                 |     |    |                 |                       |  |     |            |            |
| 55  |  | Whale, gray                  | Eastern North Pacific         | Wild | Adult          | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy  | N/A | 12/20/2018 | 12/31/2023 |
| 56  |  | Whale, gray                  | Eastern North Pacific         | Wild | All            | Male and Female | 300 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id;   | N/A | 12/20/2018 | 12/31/2023 |

|  |  |             |  |      |                    |                       |     |    |                 |                          |   |     |            |            |
|--|--|-------------|--|------|--------------------|-----------------------|-----|----|-----------------|--------------------------|---|-----|------------|------------|
|  |  |             |  |      |                    |                       |     |    |                 |                          | Photograph/Video  |     |            |            |
| Details: Whales may be approached multiple times per year for post-tag monitoring and observation. |  |             |  |      |                    |                       |     |    |                 |                          |   |     |            |            |
| 57   |  | Whale, gray | Eastern North Pacific                                  | Wild | Adult/<br>Juvenile | Male<br>and<br>Female | 2   | 4  | Harass/Sampling | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Acoustic,<br>sonar for prey mapping;<br>Collect, sloughed skin;<br>Import/export/receive,<br>parts; Instrument,<br>deep-implant;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video;<br>Sample, skin and blubber<br>biopsy | N/A | 12/20/2018 | 12/31/2023 |
| Details: Up to 2 individuals may receive 2 tag types per year.                                     |  |             |  |      |                    |                       |     |    |                 |                          |   |     |            |            |
| 58   |  | Whale, gray | Western North Pacific<br>(Korean) (NMFS<br>Endangered) | Wild | Adult/<br>Juvenile | Male<br>and<br>Female | 6   | 4  | Harass/Sampling | Survey,<br>vessel        | Acoustic, passive<br>recording; Acoustic,<br>sonar for prey mapping;<br>Collect, sloughed skin;<br>Import/export/receive,<br>parts; Instrument,<br>deep-implant;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video;<br>Sample, skin and blubber<br>biopsy | N/A | 12/20/2018 | 12/31/2023 |
| 59   |  | Whale, gray | Western North Pacific<br>(Korean) (NMFS<br>Endangered) | Wild | All                | Male<br>and<br>Female | 200 | 12 | Harass          | Survey,<br>aerial/vessel | Acoustic, passive<br>recording; Incidental<br>harassment; Observation,<br>monitoring;<br>Observations,<br>behavioral; Photo-id;<br>Photograph/Video   | N/A | 12/20/2018 | 12/31/2023 |
| Details: Whales may be approached multiple times per year for post-tag monitoring and observation. |  |             |  |      |                    |                       |     |    |                 |                          |   |     |            |            |

|   |  |                      |   |      |                |                 |     |    |                 |                       |  |     |            |            |
|---|--|----------------------|---|------|----------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
| 60  |  | Whale, Hubbs' beaked | Range-wide                              | Wild | All            | Male and Female | 10  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 61  |  | Whale, humpback      | Range-wide (NMFS Endangered/Threatened) | Wild | Adult/Juvenile | Male and Female | 48  | 4  | Harass/Sampling | Survey, vessel        | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Only one tag per individual per year.   |  |                      |   |      |                |                 |     |    |                 |                       |  |     |            |            |
| 62  |  | Whale, humpback      | Range-wide (NMFS Endangered/Threatened) | Wild | Adult          | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy  | N/A | 12/20/2018 | 12/31/2023 |
| 63  |  | Whale, humpback      | Range-wide (NMFS Endangered/Threatened) | Wild | All            | Male and Female | 500 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |                      |   |      |                |                 |     |    |                 |                       |  |     |            |            |
|   |  |                      |   |      |                |                 |     |    |                 |                       | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive,  |     |            |            |

|   |  |                         |   |      |                |                 |     |   |                 |                       |   |     |            |            |
|---|--|-------------------------|---|------|----------------|-----------------|-----|---|-----------------|-----------------------|---|-----|------------|------------|
| 64  |  | Whale, humpback         | Range-wide (NMFS Endangered/Threatened) | Wild | Adult/Juvenile | Male and Female | 2   | 4 | Harass/Sampling | Survey, aerial/vessel | parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy            | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Up to 2 individuals may receive 2 tag types per year. |  |                         |   |      |                |                 |     |   |                 |                       |   |     |            |            |
| 65  |  | Whale, killer           | Range-wide                              | Wild | All            | Male and Female | 50  | 1 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 66  |  | Whale, Lesser beaked    | Range-wide                              | Wild | All            | Male and Female | 10  | 1 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 67  |  | Whale, Longman's beaked | Range-wide                              | Wild | All            | Male and Female | 10  | 1 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 68  |  | Whale, melon-headed     | Range-wide                              | Wild | All            | Male and Female | 800 | 1 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |

|    |  |                            |            |      |     |                 |     |   |        |                       |   |     |            |            |
|----|--|----------------------------|------------|------|-----|-----------------|-----|---|--------|-----------------------|---|-----|------------|------------|
| 69 |  | Whale, minke               | Range-wide | Wild | All | Male and Female | 20  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 70 |  | Whale, northern bottlenose | Range-wide | Wild | All | Male and Female | 12  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 71 |  | Whale, Perrin's beaked     | Range-wide | Wild | All | Male and Female | 10  | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 72 |  | Whale, pilot, long-finned  | Range-wide | Wild | All | Male and Female | 400 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 73 |  | Whale, pilot, short-finned | Range-wide | Wild | All | Male and Female | 200 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 74 |  | Whale, pygmy killer        | Range-wide | Wild | All | Male and Female | 200 | 1 | Harass | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations,  | N/A | 12/20/2018 | 12/31/2023 |

|   |  |                             |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
|---|--|-----------------------------|------------------------------|------|----------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
|   |  |                             |                              |      |                |                 |     |    |                 |                       | behavioral; Photo-id;<br>Photograph/Video  |     |            |            |
| 75  |  | Whale, pygmy sperm          | Range-wide                   | Wild | All            | Male and Female | 10  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 76  |  | Whale, right, North Pacific | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 5   | 4  | Harass/Sampling | Survey, vessel        | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Only one tag per individual per year.   |  |                             |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 77  |  | Whale, right, North Pacific | Range-wide (NMFS Endangered) | Wild | All            | Male and Female | 100 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |                             |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 78  |  | Whale, right, southern      | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 48  | 4  | Harass/Sampling | Survey, vessel        | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video;                                 | N/A | 12/20/2018 | 12/31/2023 |

|   |  |                        |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
|---|--|------------------------|------------------------------|------|----------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
|   |  |                        |                              |      |                |                 |     |    |                 |                       | Sample, skin and blubber biopsy  |     |            |            |
| <b>Details:</b> Only one tag per individual per year.   |  |                        |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 79  |  | Whale, right, southern | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy  | N/A | 12/20/2018 | 12/31/2023 |
| 80  |  | Whale, right, southern | Range-wide (NMFS Endangered) | Wild | All            | Male and Female | 300 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |                        |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 81  |  | Whale, right, southern | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 2   | 4  | Harass/Sampling | Survey, aerial/vessel | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Up to 2 individuals may receive 2 tag types per year.                                     |  |                        |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 82  |  | Whale, sei             | Range-wide (NMFS Endangered) | Wild | All            | Male and Female | 50  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |



|   |  |                         |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
|---|--|-------------------------|------------------------------|------|----------------|-----------------|-----|----|-----------------|-----------------------|--|-----|------------|------------|
| 83  |  | Whale, Sowerby's beaked | Range-wide                   | Wild | All            | Male and Female | 10  | 1  | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| 84  |  | Whale, sperm            | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 48  | 4  | Harass/Sampling | Survey, vessel        | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive, parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Only one tag per individual per year.   |  |                         |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
| 85  |  | Whale, sperm            | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 20  | 1  | Harass/Sampling | Survey, vessel        | Collect, sloughed skin; Import/export/receive, parts; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy  | N/A | 12/20/2018 | 12/31/2023 |
| 86  |  | Whale, sperm            | Range-wide (NMFS Endangered) | Wild | All            | Male and Female | 300 | 12 | Harass          | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Whales may be approached multiple times per year for post-tag monitoring and observation. |  |                         |                              |      |                |                 |     |    |                 |                       |  |     |            |            |
|   |  |                         |                              |      |                |                 |     |    |                 |                       | Acoustic, passive recording; Acoustic, sonar for prey mapping; Collect, sloughed skin; Import/export/receive,  |     |            |            |

|  |  |                           |                              |      |                |                 |    |       |                            |                       |   |     |            |            |
|--|--|---------------------------|------------------------------|------|----------------|-----------------|----|-------|----------------------------|-----------------------|---|-----|------------|------------|
| 87   |  | Whale, sperm              | Range-wide (NMFS Endangered) | Wild | Adult/Juvenile | Male and Female | 2  | 4     | Harass/Sampling            | Survey, aerial/vessel | parts; Instrument, deep-implant; Observations, behavioral; Photo-id; Photograph/Video; Sample, skin and blubber biopsy            | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Up to 2 individuals may receive 2 tag types per year.                                  |  |                           |                              |      |                |                 |    |       |                            |                       |   |     |            |            |
| 88   |  | Whale, Stejneger's beaked | Range-wide                   | Wild | All            | Male and Female | 15 | 1     | Harass                     | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 89   |  | Whale, True's beaked      | Range-wide                   | Wild | All            | Male and Female | 10 | 1     | Harass                     | Survey, aerial/vessel | Acoustic, passive recording; Incidental harassment; Observation, monitoring; Observations, behavioral; Photo-id; Photograph/Video | N/A | 12/20/2018 | 12/31/2023 |
| 90   |  | Cetacean, unidentified    | NA                           | Wild | All            | Male and Female | 50 | 99999 | Import/export/receive only | Other                 | Import/export/receive, parts  | N/A | 12/20/2018 | 12/31/2023 |
| <b>Details:</b> Import/export of cetacean samples collected in foreign waters under separate authority |  |                           |                              |      |                |                 |    |       |                            |                       |   |     |            |            |

## NEPA Checklist

**1) If your activities will involve equipment (e.g., scientific instruments) or techniques that are new, untested, or otherwise have unknown or uncertain impacts on the biological or physical environment, please discuss the degree to which they are likely to be adopted by others for similar activities or applied more broadly.**

The incorporation of an acoustic dosimeter into our recoverable tag will constitute new sensor technology for our group, but will be incorporated into the previously authorized physical configuration of the tag and not constitute a change in tag dimension. Instruments to record whale vocalizations and ambient noise are not new and would not have unknown or uncertain impacts. The DTAG from Woods Hole Oceanographic Institution and National Geographic's Crittercam do this kind of recording. Our proposed acoustic dosimeter will be incorporated into our current recoverable tag, so the method by which it attaches to the whale has already been developed and tested. As with our non-recoverable satellite tag technology, this technology, if successful, will very likely be adopted by other researchers in the future, as it will offer longer-term deployments (several weeks) than current DTAG or Crittercam technology (typically less than a day). The interest in acoustics has grown over the last two decades. We do not believe that the acoustic elements will constitute a patentable product to which OSU would have rights.

**2) If your activities involve collecting, handling, or transporting potentially infectious agents or pathogens (e.g., biological specimens such as live animals or blood), or using or transporting hazardous substances (e.g., toxic chemicals), provide a description of the protocols you will use to ensure public health and human safety are not adversely affected, such as by spread of zoonotic diseases or contamination of food or water supplies.**

Our activities include the collection of biopsy samples (skin and blubber) from whales, which may involve potentially infectious agents or pathogens. All biopsy samples are handled in a sterile manner, using gloves and sterilized scalpels and forceps. Biopsy samples are stored in ethanol and frozen prior to being delivered to the Cetacean Conservation and Genomics Laboratory at Oregon State University. Biopsy dart tips and forceps are washed and heat-sterilized prior to use. Scalpels are discarded in sharps containers after each single use. The ethanol used to store biopsy samples is considered a hazardous substance and is kept in a sealed, labeled container with secondary containment.

**3) Describe the physical characteristics of your project location, including whether you will be working in or near unique geographic areas such as state or National Marine Sanctuaries, Marine Protected Areas, Parks or Wilderness Areas, Wildlife Refuges, Wild and Scenic Rivers, designated Critical Habitat for endangered or threatened species, Essential Fish Habitat, etc. Discuss how your activities could impact the physical environment, such as by direct alteration of substrate during use of bottom trawls, setting nets, anchoring vessels or buoys, erecting blinds or other structures, or ingress and egress of researchers, and measures you will take to minimize these impacts.**

Our activities will occur in coastal and offshore waters in the U.S. Exclusive Economic Zone, as well as international waters, and as such, may occur in unique geographic areas, including Critical Habitat for endangered or threatened species, Essential Fish Habitat, National Marine Sanctuaries, and Marine Protected Areas. With the exception of occasionally anchoring our research vessel overnight, which is done commonly by many vessels, our research will not impact the physical environment in unique geographic areas and the degree of physical alteration to the seafloor will be minimal. Our presence during tag applications is not consequential in terms of disturbance to non-target species, and we will not alter the substrate or water chemistry in the areas in which we operate.

There are over 1,200 Marine Protected Areas in the U.S., covering approximately 3.2 million square kilometers (26%) of U.S. marine waters. Essential Fish Habitat is also designated for much of U.S. waters. We may travel through or operate in many of these areas, such as those off the coast of Hawaii, Alaska, the U.S. west coast in the Pacific, in the Gulf of Mexico and the southeast coast of the U.S. in the

**4) Briefly describe important scientific, cultural, or historic resources (e.g., archeological resources, animals used for subsistence, sites listed in or eligible for listing in the National Register of Historic Places) in your project area and discuss measures you will take to ensure your work does not cause loss or destruction of such resources. If your activity will target marine mammals in Alaska or Washington, discuss measures you will take to ensure your project does not adversely affect the availability (e.g., distribution, abundance) or suitability (e.g., food safety) of these animals for subsistence uses.**

Our work will not affect sites listed in or eligible for listing in the National Register of Historic Places, nor will it cause loss or destruction of scientific, cultural, or historic resources. We do not anticipate altering water chemistry or the substrate in any areas. Our research will not adversely affect the availability or suitability of animals for subsistence uses because we are not removing animals, nor are our activities expected to cause anything more than short-term behavioral disturbance. We will not operate in areas where subsistence harvest for bowhead whales occurs, but we may operate in the Makah Whaling Area off Washington. We will coordinate with the Makah to avoid conducting research in any area that would interfere with their gray whale subsistence activities.

**5) Discuss whether your project involves activities known or suspected of introducing or spreading invasive species, intentionally or not, (e.g., transporting animals or tissues, discharging ballast water, use of equipment at multiple sites). Describe measures you would take to prevent the possible introduction or spread of non-indigenous or invasive species, including plants, animals, microbes, or other biological agents.**

It is possible that our activities involve the transport of materials from one area to another, when we operate our larger research vessel. The hull is coated with anti-fouling paint to reduce this possibility, however, and we do not use water as ballast. When operating our small boats, the boats are removed from the water on a daily basis and thoroughly hosed off to prevent the transport of material to another water body.

Project Contacts

Responsible Party: Bruce Mate  
Primary Contact: Barbara Lagerquist  
Principal Investigator: Bruce Mate

| Other Personnel |         |
|-----------------|---------|
| Name            | Role(s) |

|                    |                 |
|--------------------|-----------------|
| Craig Hayslip      | Co-Investigator |
| Ladd Irvine        | Co-Investigator |
| Barbara Lagerquist | Co-Investigator |
| Daniel Palacios    | Co-Investigator |

Attachments

- Application Archive - (Added Dec 20, 2018)
- Certification of Identity - (Added Dec 5, 2017)
- Contact - Barbara Lagerquist (Added Apr 15, 2010)
- Contact - Barbara Lagerquist (Added Sep 20, 2010)
- Contact - Barbara Lagerquist (Added Nov 16, 2017)
- Contact - Barbara Lagerquist (Added May 3, 2018)
- Contact - Bruce Mate (Added Apr 4, 2012)
- Contact - Bruce Mate (Added Sep 20, 2010)
- Contact - Craig Hayslip (Added Sep 20, 2010)
- Contact - Craig Hayslip (Added Mar 18, 2014)
- Contact - Craig Hayslip (Added Jan 19, 2019)
- Contact - Daniel Palacios (Added Dec 1, 2017)
- Contact - Daniel Palacios (Added Mar 17, 2014)
- Contact - Ladd Irvine (Added Dec 11, 2009)
- Project Description - (Added Jun 28, 2018)
- Project Description - (Added May 3, 2018)
- Project Description - (Added Jun 28, 2018)
- Project Description - (Added Jun 5, 2018)
- Project Description - (Added Jun 5, 2018)

Status

|                                 |   |
|---------------------------------|---|
| Application Status:             | Application Complete  |
| Date Submitted:                 | December 5, 2017  |
| Date Completed:                 | June 21, 2018   |
| FR Notice of Receipt Published: | July 9, 2018    Number: 2018-14676                                |
| Comment Period Closed:          | August 8, 2018    Comments Received: No    Comments Addressed: No |
| Last Date Archived:             | May 13, 2020  |

- MMPA/ESA Research/Enhancement permit
  - Current Status: Issued    Status Date: December 20, 2018
  - Section 7 Consultation: Formal Consultation
  - NEPA Analysis: Categorical Exclusion
  - Expire Date: December 31, 2023

Analyst Information:

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Modification Requests

| Modifications Requested |  |   |                      |                |             |                |
|-------------------------|--|---|----------------------|----------------|-------------|----------------|
| Number                  | Title  | Description   | Status               | Date Submitted | Date Issued | Issued Version |
| 1                       | Modification to tagging methodology - antibiotic application | We would like the option of eliminating the antibiotic coating on some of our implant tag housings. Currently our permit application states that "Tag cylinders are partially coated with a broad-spectrum antibiotic (gentamicin sulfate, 2.5 grams per tag) mixed with a long-dispersant methacrylate". We still feel adding an antibiotic coating to implant tags is a worthwhile procedure, but there have been concerns regarding antibiotic use raised by the Best Practice Guidelines for Cetacean Tagging (Andrews et al. 2019). In their guidelines, Andrews et al. (2019) state that "the efficacy of antibiotic use in reducing tag site infection is unclear (due to the spectrum of potential organisms involved, including fungi). It may potentially have deleterious effects on beneficial flora and can enhance development of specific antibiotic resistance, and thus use should be conducted with caution and be subsequently evaluated." While we do not believe our antibiotic application harms whales in any way, nor do we agree that such a small amount would contribute to antibiotic resistance in the marine environment, we do agree that their efficacy is unknown. We would therefore like the application of antibiotic coatings to be optional, as we continue to explore if tag wound healing and tag attachment are noticeably different under the two treatments. We would also like the option of testing other antibiotics (yet to be determined), in addition, or as alternatives to gentamicin sulfate (which primarily fights gram-negative bacteria), to provide a more broad-spectrum product capable of fighting a variety of bacteria strains, as well as potentially including an antifungal agent. Our institution's IACUC office has informed us that an IACUC permit modification will be required to authorize such flexibility in antibiotic application on our tags, so we will be simultaneously submitting a modification request to them. That process takes approximately two weeks to approve. | Issued               | 02/26/2020     | 03/23/2020  |                |
| 2                       | Increase Level B takes for humpback whales                   | We would like to increase our total number of Level B takes for humpback whales to 900 annually (Permit Line No. 63). No other changes to our objectives or methods are proposed at this time. Our current permit authorizes 500 Level B takes for humpback whales per year, which we felt was adequate with the new method of counting takes (counting only one take per day) that was implemented by the Permits Office with our current permit, issued in December 2018. However, after field seasons in Hawaii and northern Washington in 2019, in which we encountered an average of 35 whales per day, we ended up exceeding our authorized Level B takes by 68. The estimated number of whales we took last year is very likely an over-estimate of the number of actual Level-B takes that occurred, as, on any given field season, we potentially approach the same animal more than once over the course of a day and wouldn't know it in real time unless the animal was very conspicuously marked (very identifiable). In counting Level B takes, we also conservatively use our largest estimate of group size when more than one whale is approached. For example, if we estimate group size to be 10 to 15 whales, we record 15 Level B takes, rather than 10. In groups larger than five, it can often be hard to accurately count all individuals if they are engaged in fast-paced and tortuous movements such as in competitive breeding or feeding aggregations, or if our time with them is short. Thus, it can be nearly impossible to get accurate counts in groups larger than 10. Where we worked last fall in the Strait of Juan de Fuca and Swiftsure Bank off Washington State, it is not uncommon to   | Application Complete | 05/04/2020     |             |                |

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|  | <p>encounter large aggregations of whales feeding within a relatively small area (within less than a 400-yard radius). The fast-paced dynamics of these situations make it not only very difficult to get an accurate count of animals, but also make it difficult to tell exactly which animals we approach closer than 100 yards. In those situations, we also conservatively over-estimate our number of Level B takes by considering all animals in the aggregation to have been approached. An increase from the currently permitted 500 takes up to 900 Level B takes annually for humpback whales (Permit Line No. 63) would allow us to conduct three field seasons per year with a potential to approach 300 whales during each season. As stated above, the real number of takes would likely be less than that, but we will continue to conservatively count takes as we have in the past. Most of our Level B approaches last less than 30 minutes and have very little noticeable effect on the animals. As the North Pacific humpback whale population is recovering (Bettridge et al. 2015, Wade et al. 2016), with numbers increasing in both Hawaii (Bettridge et al. 2015) and northern Washington (Calambokidis et al. 2017), we believe this increase in Level B takes will have no significant impact on the population. Humpback whales encountered in Hawaii are part of the Hawaii Distinct Population Segment (DPS) which is considered to be large and growing (Bettridge et al. 2015). Most of the humpback whales in northern Washington (and southern British Columbia) are part of the Hawaii or Mexico DPS, with a much smaller proportion from the Central America DPS (Wade et al. 2016, Calambokidis et al. 2017). The Mexico DPS is considered to have a large and increasing population size (Bettridge et al. 2015). The Central America DPS has a relatively small population size and an unknown growth rate (Bettridge et al. 2015). While most of our humpback whale research has taken place in Hawaii or Washington in the past two years, we may also operate in other areas in the future. Thus, we may encounter more whales from other DPSs, including the Central America DPS if we conduct work in Oregon or California or the Western North Pacific DPS if we conduct work elsewhere in the North Pacific, such as the Aleutian Islands. The Western North Pacific DPS is relatively small and is apparently showing signs of increase (Wade et al. 2016), but overall recovery seems to be slower than for humpback whales in the Central and Eastern North Pacific (Bettridge et al. 2015). While the Central America and Western North Pacific DPSs are considered endangered, we believe our Level B takes on these whales will not negatively affect their populations, given the low impact these short-term, often distant (between 20 to 100 yards) approaches have on individual whales. Personnel Changes In addition, with Dr. Bruce Mate's retirement as Director of the Marine Mammal Institute, we would like to change the Responsible Party on our permit to our new Director, Dr. Lisa Ballance. We would also like to make Dr. Daniel Palacios as the Principal Investigator on the permit. References Bettridge, S., C.S. Baker, J. Barlow, P.J. Clapham, M. Ford, D. Gouveia, D.K. Mattila, R.M. Pace III, P.E. Rosel, G.K. Silber, and P.R. Wade. 2015. Status Review of the Humpback Whale (<i>Megaptera novaeangliae</i>) Under the Endangered Species Act. NOAA Technical Memorandum NMFS-SWFSC-540. National Marine Fisheries Service, La Jolla, California. 240 pp. Calambokidis, J., J. Barlow, K. Flynn, E. Dobson, and G.H. Steiger. 2017. Update on abundance, trends, and migrations of humpback whales along the US West Coast. 17pp. Paper SC/A17/NP/13 presented to the IWC Workshop on the Comprehensive Assessment of North Pacific Humpback Whales, 18-21 April 2017, Seattle, USA. 9pp. Available at <a href="https://archive.iwc.int/">https://archive.iwc.int/</a>. Wade, P.R., T.J. Quinn II, J. Barlow, C.S. Baker, A.M. Burdin, J. Calambokidis, P.J. Clapham, E. Falcone, J.K.B. Ford, C.M. Gabriele, R. Leduc, D.K. Mattila, L. Rojas-Bracho, J. Straley, B.L. Taylor, J. Urbana R., D. Weller, B.H. Witteveen, and M. Yamaguchi. 2016. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. Paper SC/66b/IA21 submitted to the Scientific Committee of the International Whaling Commission, June 2016, Bled, Slovenia. 41pp. Available at <a href="https://archive.iwc.int/">https://archive.iwc.int/</a>.</p> |  |  |  |  |
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Reports

| Reports Required |             |               |          |          |        |
|------------------|-------------|---------------|----------|----------|--------|
| Nbr              | Report Type | Report Period |          | Date Due | Status |
|                  |             | Start Date    | End Date |          |        |
|                  |             |               |          |          |        |

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|---|-----------------------|------------|------------|------------|-----------|------------|
| 1 | Annual                | 12/20/2018 | 12/31/2019 | 04/30/2020 | Submitted |            |
| 2 | Annual                | 01/01/2020 | 12/31/2020 | 03/31/2021 | N/A       |            |
| 3 | Annual                | 01/01/2021 | 12/31/2021 | 03/31/2022 | N/A       |            |
| 4 | Annual                | 01/01/2022 | 12/31/2022 | 03/31/2023 | N/A       |            |
| 5 | Combined Annual/Final | 01/01/2023 | 12/31/2023 | 03/31/2024 | N/A       |            |
| 6 | Incident              | 10/02/2019 | 10/06/2019 | 10/06/2019 | Submitted | 04/17/2020 |